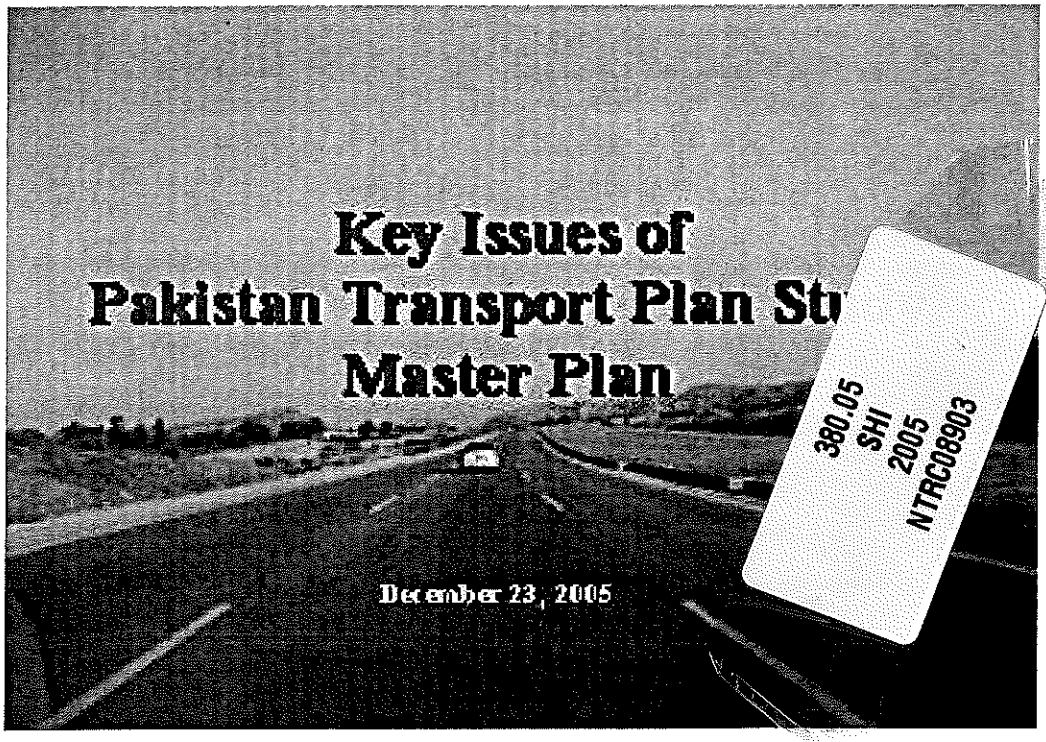
Discussion Material

For

The 3rd Steering Committee Meeting

Date: 23rd December 2005
Venue: in the Committee Room
Ministry of Communication



December, 2005

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Preface

JICA Study Team in collaboration with NTRC have been working for last 6 months and now we are coming to the stage to finalize the main important items in PTPS.

Before starting to finalize the Draft Final Report, we intend to explain and introduce in this Steering Committee the main issues and our directions to be incorporated in the Draft Final Report. We are very happy if you give us your frank opinions and comments on our joint efforts and way of thinking.

The most important issue in PTPS is to determine the most appropriate modal share between road and railway. To materialize the rational modal share, we are contemplating that the reform of railway organization and management system is one of the key issue and must.

In formulating our plan, we jointly with NTRC conducted very extensive traffic surveys in this summer time and prepared transport data base. Based on our data base, we conducted future traffic projections and determined a priority of each project.

This data base will be utilized from now on for all type of traffic related projects and analysis in Pakistan and will become indispensable materials for transport related planning. We will introduce in this meeting some of the actual examples.

In this meeting, we are expecting your constructive comments on our presentation, while we will endeavor at our most to complete the Draft Final Report incorporating your comments. We are planning to make the next steering committee to present on Draft Final Report and Seminar presentation in the middle of February.

Minoru Shibuya
Team Leader for JICA Study Team
for Pakistan Transport Plan Study
in the Islamic Republic of Pakistan

Key Issues of PTPS Master Plan

1. Study Framework and Progress
2. Budget Envelope 2006-2030
3. Traffic Survey Results and Findings
4. Demand Forecast
5. Future Road Network
6. Strategic Modal Share between Road and Rail
7. Reform and Development of the Pakistan Railways
8. Investment Requirement
9. Evaluation of PTPS Master Plan
10. Restoration of Road and Bridges damaged by the Earthquake
11. Toward Finalization of PTPS Master Plan

1 Study Framework and Progress

1.1 Study Objectives

1. **Master Plan**

   To formulate the national transport Master Plan (MP: target year 2025) for the whole country of Pakistan covering all transport modes.

2. **Feasibility Study**

   To identify the priority projects and carry out feasibility study (F/S) for selected priority projects

3. **Technology Transfer**

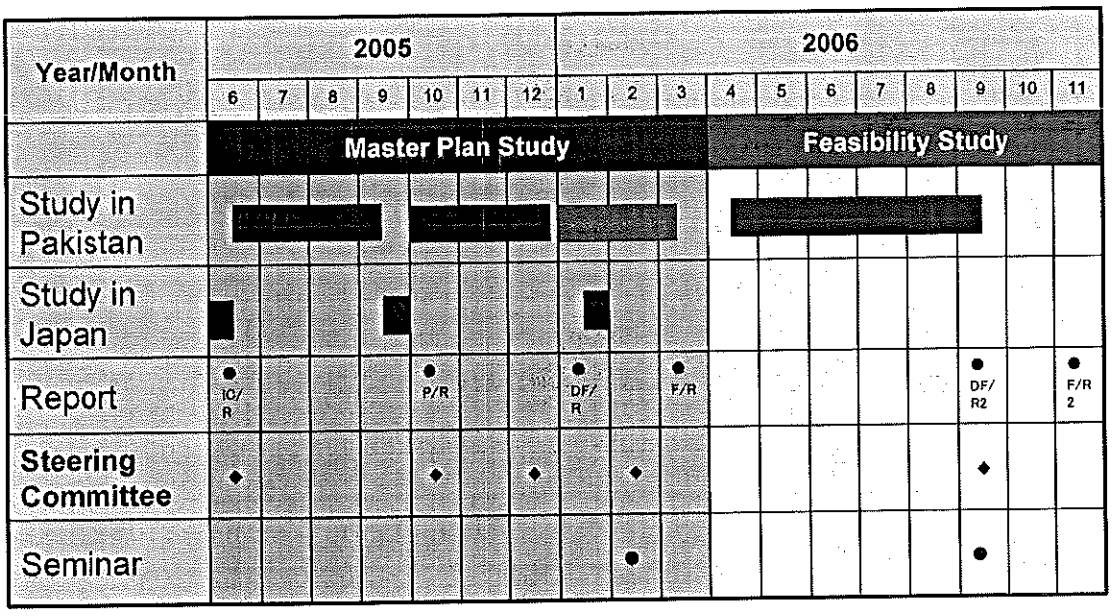
   To promote transfer of knowledge and technology, which is necessary to modify, revise and update the master plan by the counterparts in transport sector authorities of Pakistan

1.2 Time Framework

The PTPS started July 2005 and will end November 2006, taking 18 months. The first 7 months are spent for developing the Transport Master Plan and the rest for the Feasibility Study on selected priority projects.

Submission of the draft final report of the Master Plan was postponed by one month, mainly due to the earthquake on 8th of October, in order to incorporate a road restoration plan into this Study.

Figure 1.1 Time Framework of PTPS



1.3 Work Framework and Planning Policies

Figure 1.2 Work Framework of Phase 1: PTPS Master Plan Development

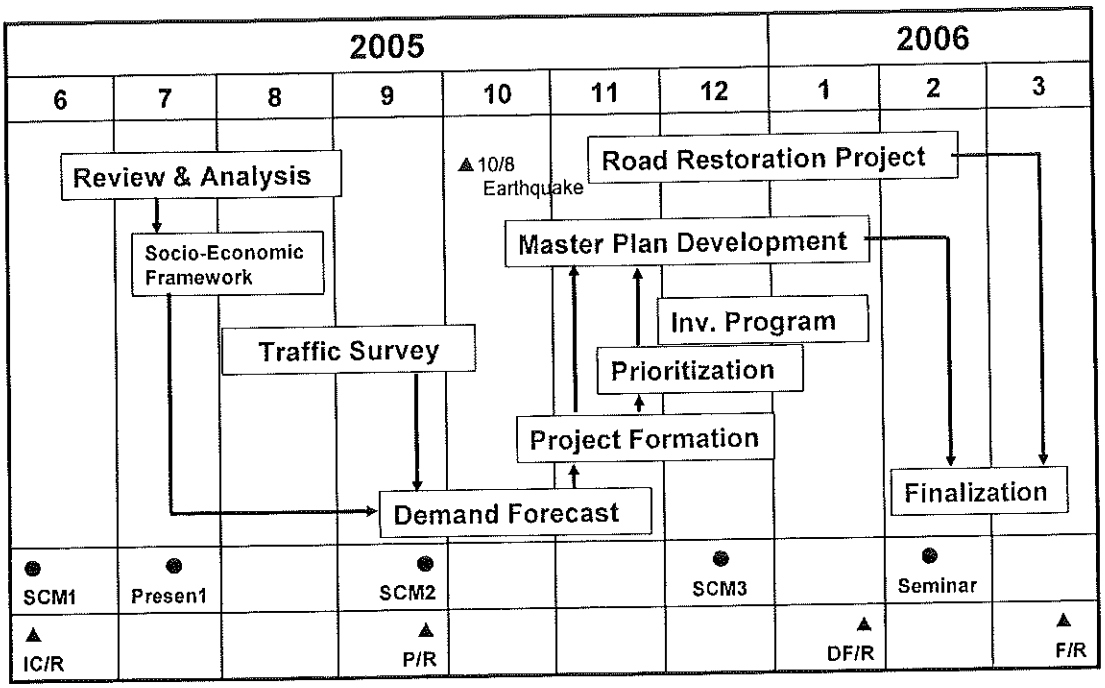
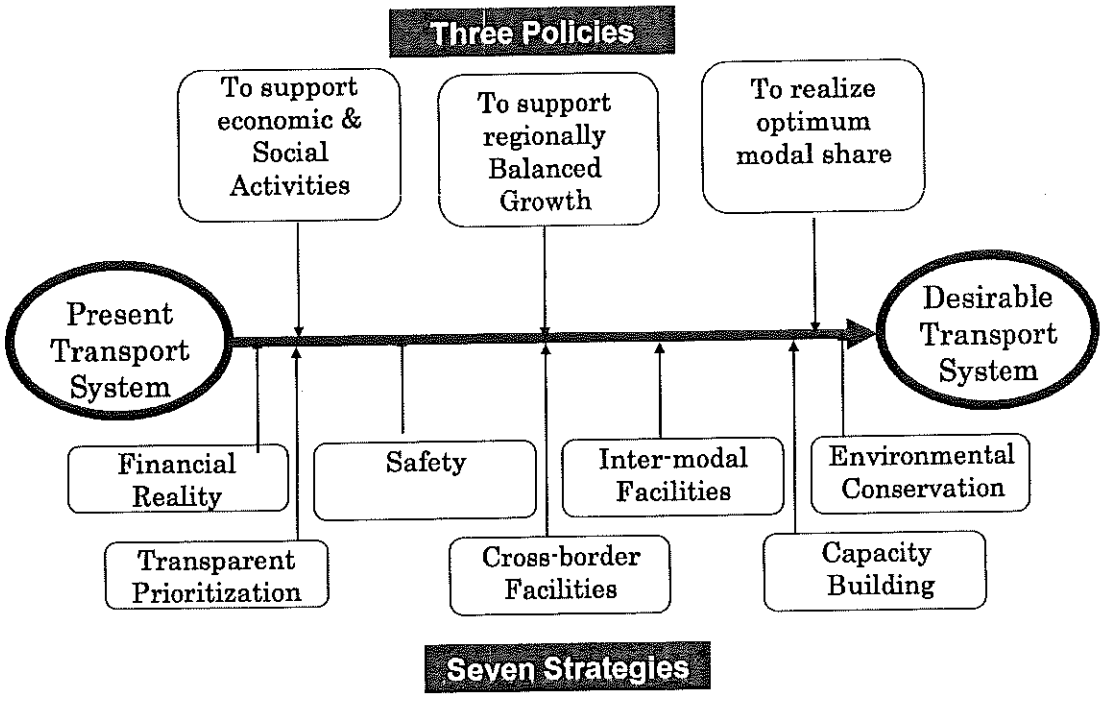


Figure 1.3 Planning Policies and Strategies



2 Budget Envelope 2006-2030

2.1 Economic Growth

Based on a good performance of economic growth in 2000 – 2004, the Government aimed at a high growth of 7% - 8.5% in 2005 – 2010 in the MTDF. In this Study, three scenarios were set up for a long-term.

(1) High Growth : Maintaining high growth at 7.6% (Av. of 2005 – 10)
(2) Medium Growth : Moderate declining down to 5.0%
(3)Low Growth : Declining trend down to 3.0%

Figure 2.1 Three Cases of Economic Growth

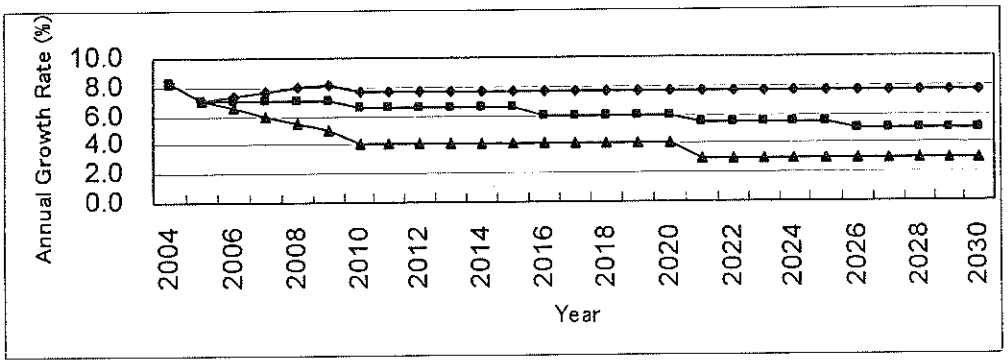
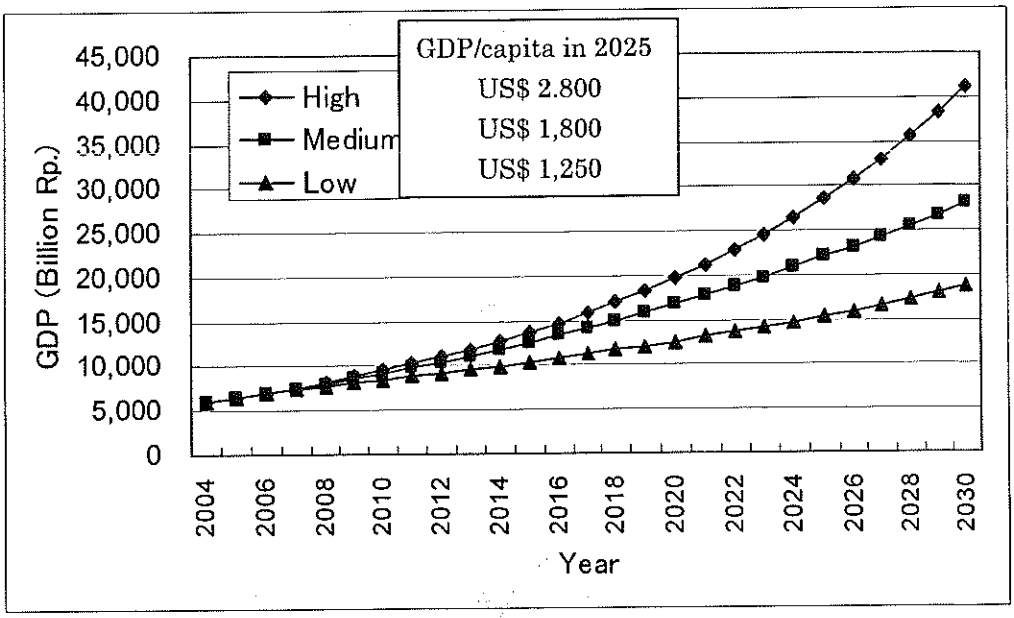


Figure 2.2 Projection of GDP and GDP per capita



In the coming 20 years until 2025, the Pakistan economy will expand 3.3 times in high case, 2.5 times in medium case and 1.7 times of low case, respectively. Accordingly, GDP per capita will rise from US$ 700 at present to US& 2,300, US$ 1,800 and US$ 1,250 in each case. In this Study, the medium case is assumed as the planning base.

2.2 Budget Envelope for Transport Development

Historically, the countries which had attained a high economic growth such as Korea, China, Thailand and Vietnam, invested a sizeable amount equivalent to 2.0 to 4.0% of GDP into the transport sector during such a period. In order to realize the planned high growth, Pakistan will need to increase the investment amount at least up to 2.0% and over of GDP.

However, past performance shows a lower level of investment at 0.86% of GDP in 2000 – 2004. Even a "so-called" ambitious plan of MTDF envisages total investment of US$ 573 billion (US$9.6 billion), that is, 1.46% of GDP. (Table 2.1).

Table 2.1 shows possible investment in the transport sector during the planning period, based on the medium growth case, assuming respective rates to GDP mentioned above. In this Study, an amount of US$ 85 billion corresponding to 2.0% of GDP was regarded as a target investment amount in the course of planning. If the same shares of fund sources are assumed, the Government should shoulder more than a half of the amount.

Table 2.1 Possible Budget Envelope in 2006 - 2025

(US$ Billion)

% of GDP	GOP	Corporation and SOE	PPP/Private Sector	Total
2.50%	55.1	30.4	20.8	106.3
2.00% (Target)	44.1	24.3	16.6	85.0
1.46% (MTDF)	32.2	17.8	12.2	62.2
0.86% (2000-04)	18.9	10.4	7.1	36.4

3. Traffic Survey Result and Findings

3-1. Brief History of Nation-wide O/D Survey

Year	Survey	Analysis	Five Year Plan
1968-69:	1st O/D Survey	TRACO Study	The 3rd Five Year Plan
1979-80:	2nd O/D Survey (NTRC)	National Transport Plan Study (NTPS, JICA)	The 6th Five Year Plan The 7th Five Year Plan
1990-91:	3rd O/D Survey (NTRC)	National Transport Plan (NTP, JICA)	The 8th Five Year Plan
2005	4th O/D Survey (JICA)	Pakistan Transport Plan Study (PTPS, JICA)	MTDF

There were three nation-wide O/D surveys carried out in Pakistan, which has been used in comprehensive studies of transport sector, including successive National Transport Plan Studies (NTPS) by JICA. The studies are 1) The 1st NTPS (1981-83), 2) The 2nd NTPS (1986-88), and 3) The 3rd NTPS (1994-1995). The results of these studies had contributed to the then Five Year Plans as well as annual development programs.

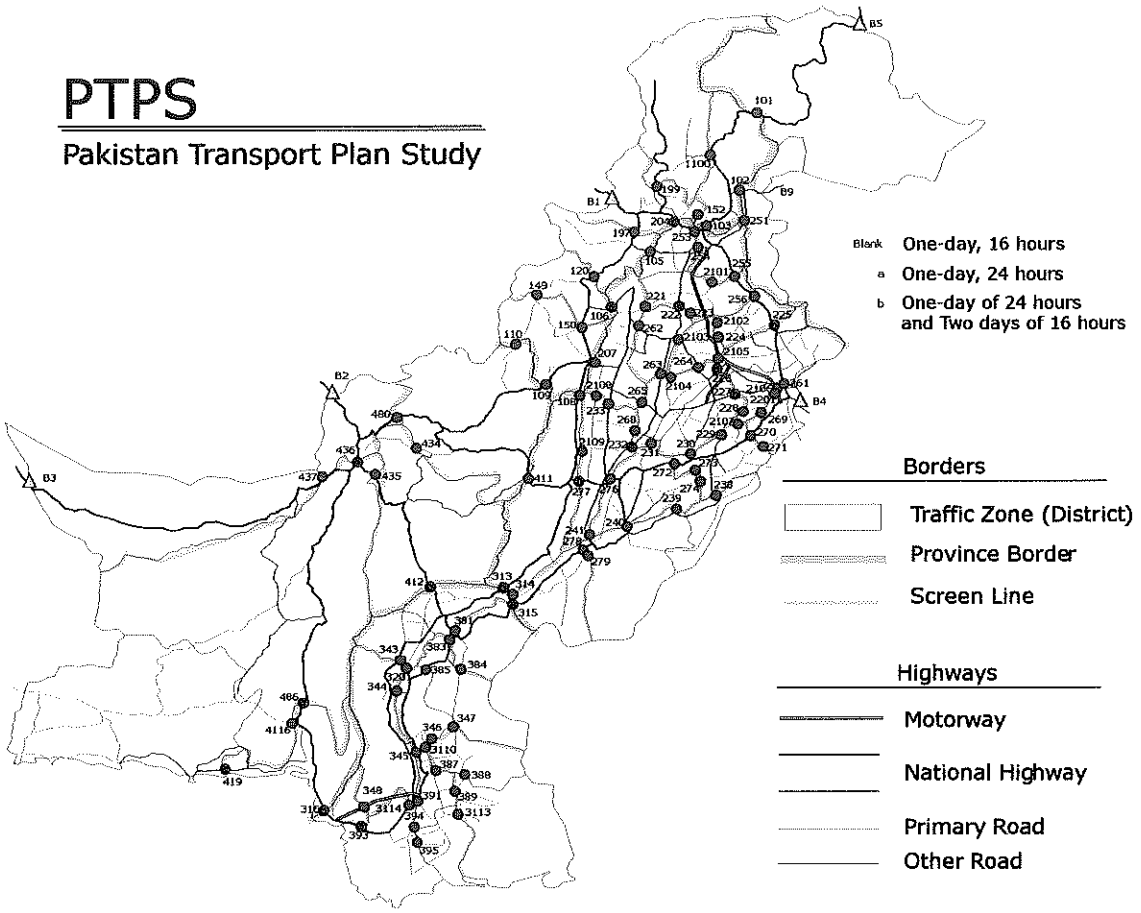
The O/D Survey in PTPS is the fourth county-wide O/D Survey, and the first O/D Survey conducted by JICA (The 2nd and 3rd O/D Surveys were conducted by NTRC.).

3-2. Survey Types

The major component of PTPS Traffic Survey was Roadside O/D Interview Survey (RIS) at 100 locations as well as Manual Classified Traffic Count Survey (MCC) at the 100 same locations of RIS. In addition to RIS and MCC Survey, PTPS carried out other surveys such as Detailed Truck Classification Survey, Cross-border Traffic Count Survey, Long-distance Bus Survey, and Passenger Interview Survey.

Category	Survey	Nos.
O/D Survey	Roadside OD Interview Survey (RIS)	100
	Cargo O/D Survey at Dry Depots	10
Manual Classified Traffic Count Survey (MCC)	24 hours Traffic Count	17
	16 hours Traffic Count	83
	Three days Traffic Count (one day 24hours and two days 16hours)	6
	Detailed Truck Classification Survey	(4)
	Cross-border Traffic Count Survey	5
Passenger Transport Survey	Long-distance Bus Survey	10
	Passenger Interview Survey at Railway Stations	5
	Passenger Interview Survey at Airport	5
	Passenger Interview Survey at Bus Terminal	5

3-3. Survey Locations

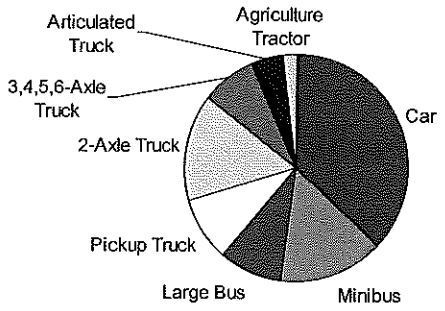


The survey locations of the Roadside O/D Interview Survey (RIS) were originally selected on the major roads crossing boundaries of the traffic zones in the NTPS (1995-06). However, it turned out that some boundaries had many crossing points, and it was difficult to make cordon lines that corresponded to the traffic zone boundaries. Therefore, some traffic zones were merged so that the all zones could be bordered by cordon lines.

Cross-border traffic count survey	Cargo O/D Survey at Dry Depot	Long-distance Bus Survey	Passenger Interview Survey
Sust (to China)	Peshawar	Peshawar	Peshawar
Wagha (to India)	Rawalpindi	Islamabad	Islamabad
Torkhan (to Kabul)	Lahore	Lahore	Lahore
Chaman (to Kandahar)	Faisalbad	Faisalabad	Multan
Taftan (to Iran)	Karachi	Karachi	Karachi
	Quetta	Quetta	
	Multan	Multan	
	Hyderabad	Hyderabad	
	Port Qasim	Sukkur	

3-4. The Result of the Traffic Survey

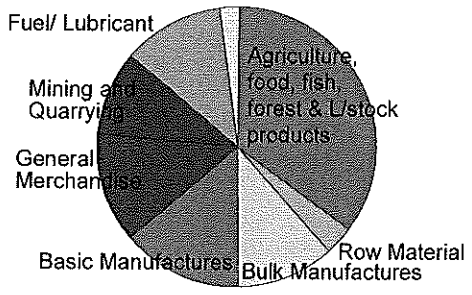
- More than 445,000 vehicles were counted.
- Over 71,000 vehicles were interviewed.
- Total sampling rate of RIS was about 16%.
- Cars, buses and trucks accounted for 37%, 24%, and 39%, respectively.
- Empty trucks accounted for 26% in total, and it was 17% along N-5.
- The percentage of empty trucks toward up-country along N-5 is low at 11%.
- Container truck accounted for 3% of the total truck.
- Average freight loading of Truck was 11.3tons/truck
- Average passenger loading of Minibus and Bus were 17 and 45 passengers/vehicle
- Peak hour traffic volume was about 7 – 8% of the 24hours traffic, but it was observed at 11 – 13% at some sites.



Vehicle Composition

Average Loading of Truck

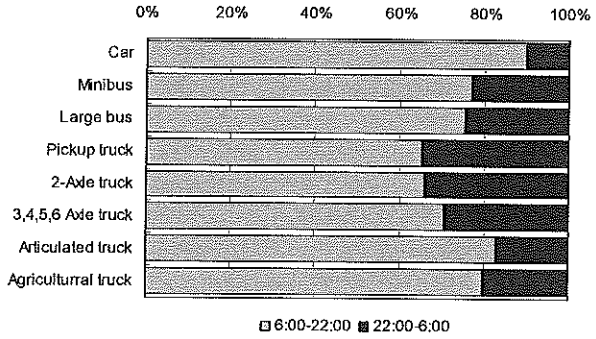
Truck Type	Tons/Truck
Light Truck	2.7
2-Axle Truck	8.5
3 or more Axle Truck	16.9
Articulated Truck	23.7
Agricultural Truck	4.8
All Trucks	11.3



Composition of Commodity Carried by Truck

Traffic Volume along National Highways

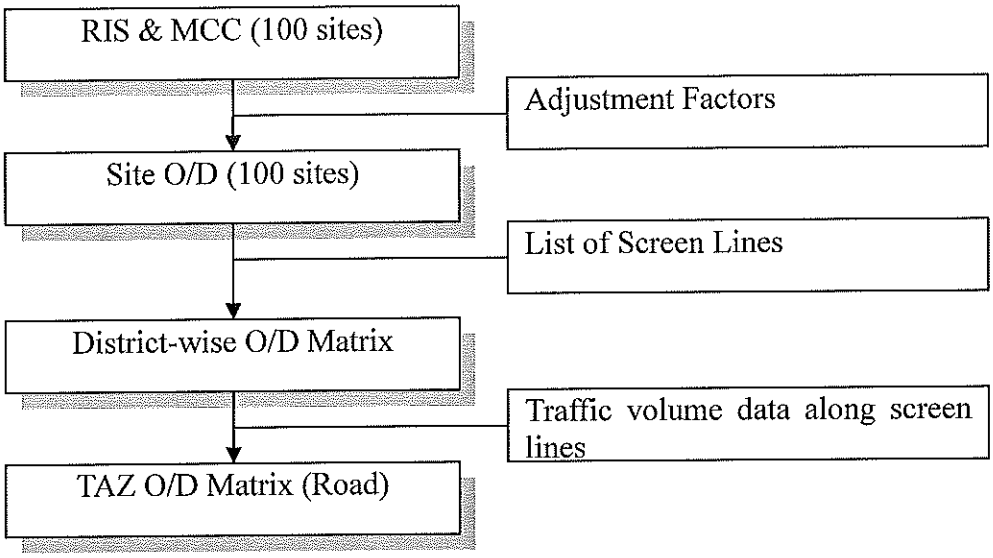
Road Section	#site	volume	Car	Bus	Truck
N-5					
Peshawar-Rawalpindi	204	12,827	39.1	25.2	35.7
Rawalpindi-Lahore	256	17,287	47.7	14.9	37.4
Lahore-Multan	272	8,080	28.6	16.1	55.3
Multan-Sukkur	315	6,814	9.8	9.6	80.6
Sukkur-Hyderabad	345	7,332	19.6	12.0	68.4
N-25					
Hub-Khuzdar	486	1,733	16.1	21.2	62.7
Khuzdar-Quetta	436	3,813	21.3	26.3	52.4
N-35					
Hassanabdal-Abbotabad	103	8,112	44.7	34.0	21.3
N-40					
Lakpass-Noshki	437	916	18.7	27.0	54.4
N-50					
D.I.Khan-Zhob	109	238	22.7	23.9	53.4
N-65					
Jacobabad-Sibi	412	2,997	14.7	21.1	64.2
N-70					
D.G.Khan-Loralai	411	1,392	11.7	17.8	70.4
N-55					
Peshawar-D.G.Khan	150	3,068	16.4	24.3	59.3
D.G.Khan-Jacobabad	313	1,924	11.7	23.5	64.8
Jacobabad-Hyderabad	343	1,353	30.6	39.5	29.9



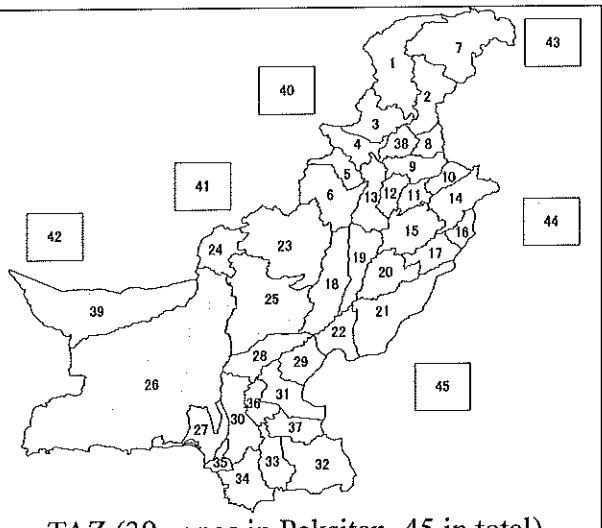
16hours/24hours traffic volume ratio

3-5. Making O/D Matrices

The present vehicle O/D matrix was created according to the following steps.



The zoning system in PTPS is almost the same as that of the previous NTPS (1995-96). There are 45 Traffic Analysis Zone (TAZ) in the PTPS Zoning system, including 39 zones in Pakistan and 6 zones in the external area.
Vehicle O/D Matrices was created by combining 100 Site OD Matrices, which were calculated from the result of RIS and MCC Survey.



TAZ (39 zones in Paksitan, 45 in total)

The O/D pair between "A" Zone and "B" Zone can be calculated using Line-1, Line-2, Line-3, and Line-4. This creates four different O/D pairs that must be equal ideally.

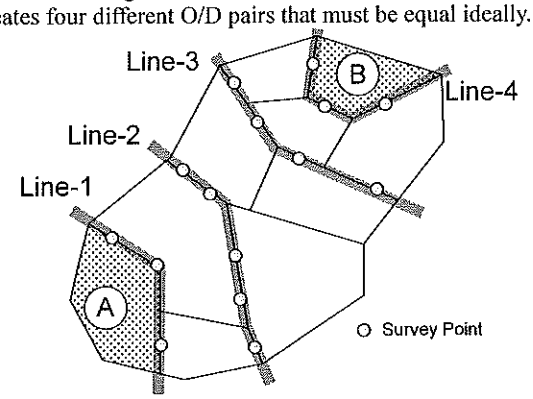
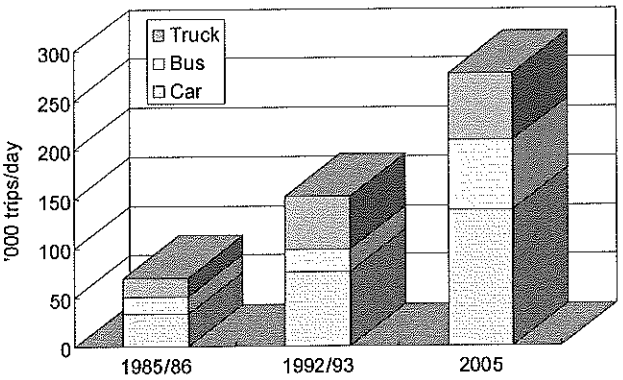


Illustration of Sample for O/D Pair Calculation

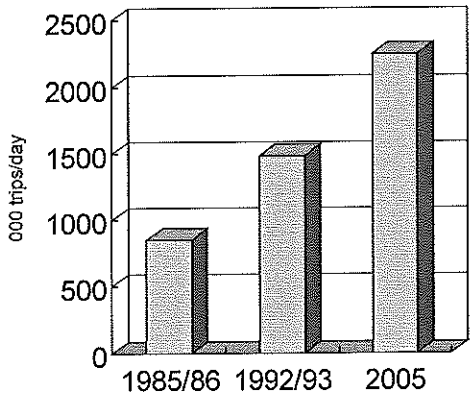
3-6. Trip Generation/Attraction

The number of vehicle trip from/to the 45 traffic zones was calculated at 277, 000 vehicle trips/day in total. The vehicle trip was 153,000 vehicles/day in 1992/93, and 70,000 vehicles/day in 1985/86.

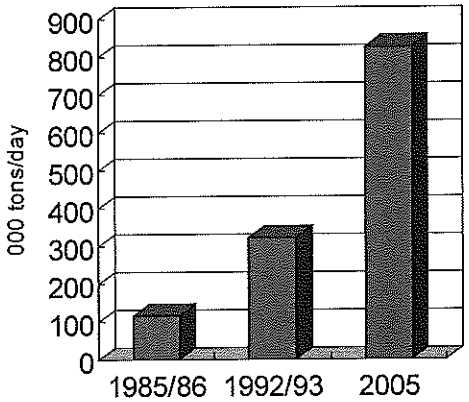
The number of passenger trips and freight trips form/to the 45 traffic zones were estimated at 2.25 million passengers/day and 0.83 million tons/day in total.



Vehicle Trip



Passenger Trip

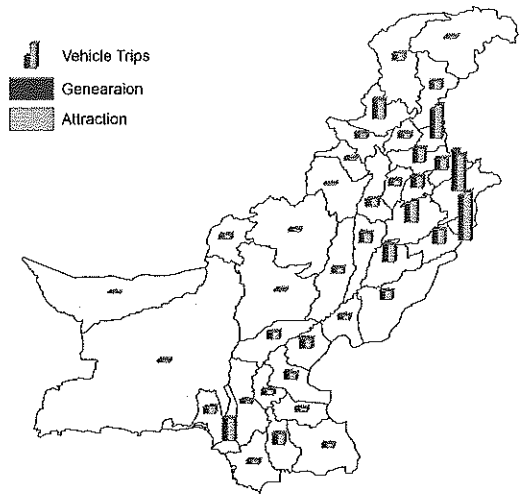
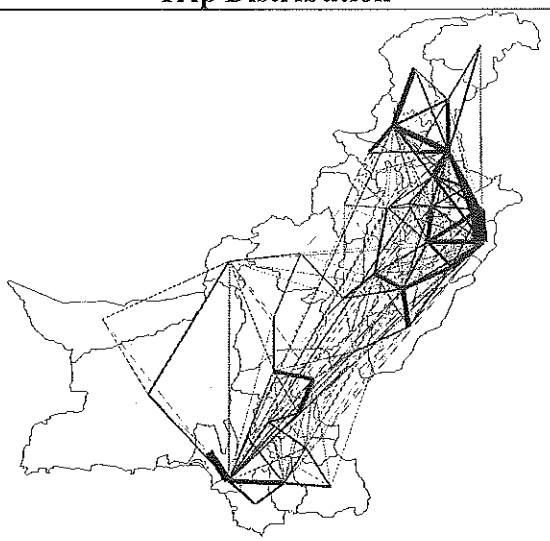
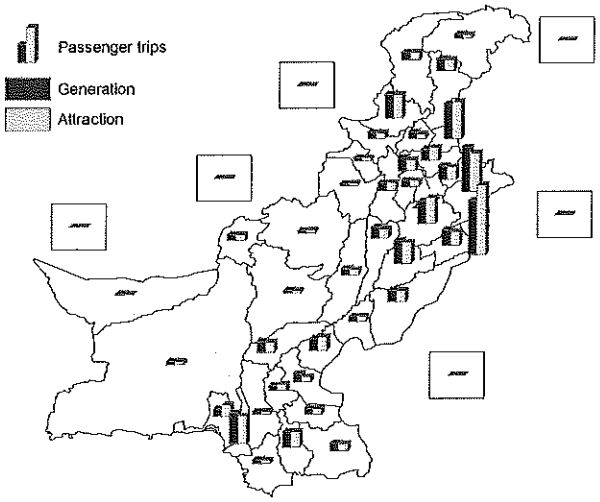
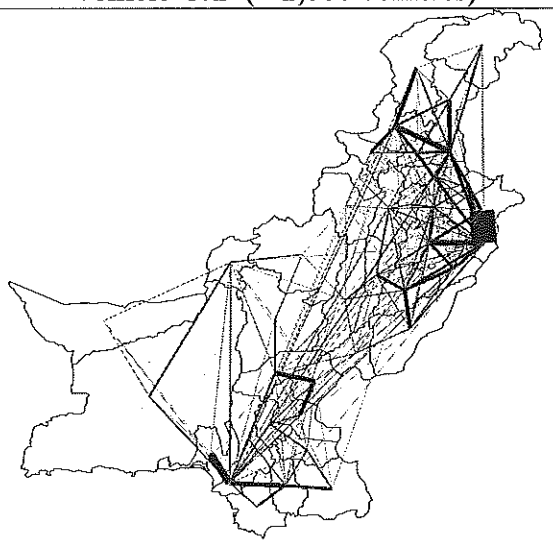
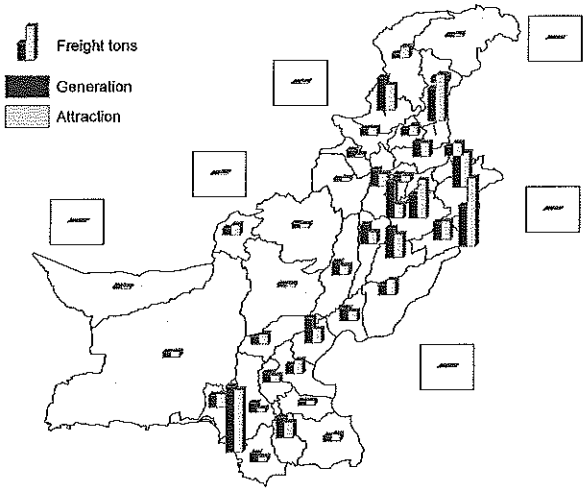
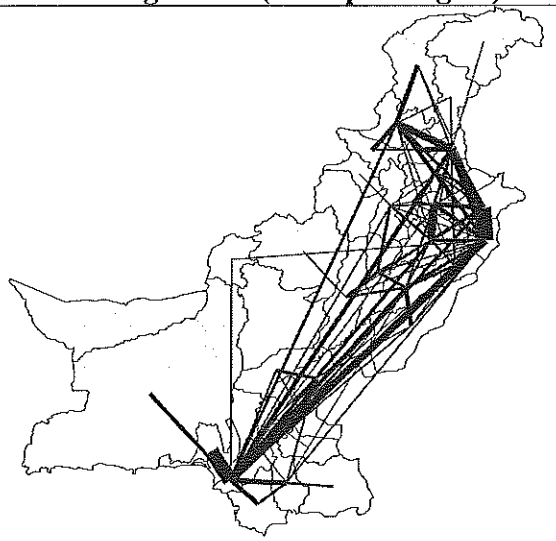


Freight Trip

The vehicle trip concentrates in Panjab Province accounting for 64% of the total trips. Lahore zone (#16) itself accounts for 12%, followed by Sialkot-Gujranwala-Sheikhupura zone (#14) at 10%, and these two zones account for 21% of the total trips. Islamabad-Rawalpindi zone (#8) and Karachi zone (#35) accounts for 8% and 6%, respectively. Passenger trip shows the similar pattern to the vehicle trip, while freight trip shows the different tendency. Karachi zone itself accounts for 11% of the total freight trip.

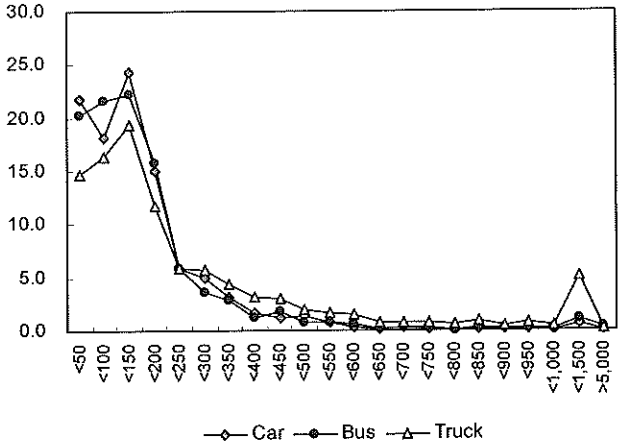
3-7. Trip Distribution

Trip distribution (Figures in the next page) shows a clear difference between passenger O/D and freight O/D. Major movements of passenger cars are such trips that just cross the boundary of two zones, and high passenger volume is observed from/to Lahore, Islamabad/ Rawalpindi, Faisalbad, and Karachi. On the other hand, freight O/D shows high transport intensity on the north-south corridor along N-5, and Karachi zone is the major node where freight transport generate from and concentrate to. This is because Karachi is the major gate of international trade in Pakistan, and it forces the country to bear the long-distance land transport and high transport cost. The result of the analysis implies that the reduction in transport cost for long distance is a key issue in transport sector.

Trip Generation/Attraction	Trip Distribution
	
Vehicle Trip	**Vehicle O/D (> 1,000 vehicles)**
	
Passenger Trip	**Passenger O/D (>500 passengers)**
	
Freight Trip	**Freight O/D (> 1,000 tons)**

3-8. Trip Length Distribution

Vehicle trips of car, bus and truck whose trip length is less than 100km accounted for 40%, 42%, and 31%, respectively. The average trip length was smaller than that of 1990 O/D Survey.



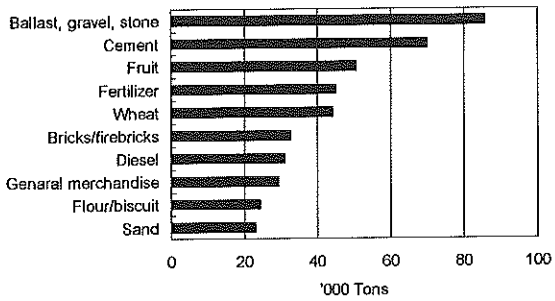
Comparison of the Average Trip Length with 1990 O/D Survey

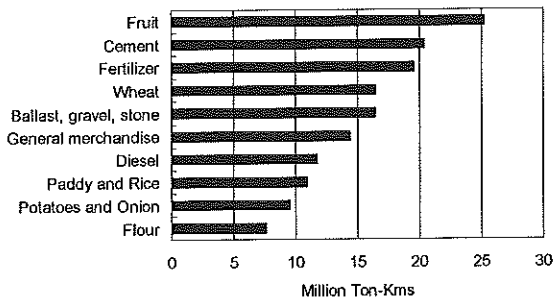
	1990 O/D, NTRC	2005 O/D, JICA
Car	163km	152km
Bus	203km	163km
Truck	345km	266km

3-9. Yearly Transport Volume

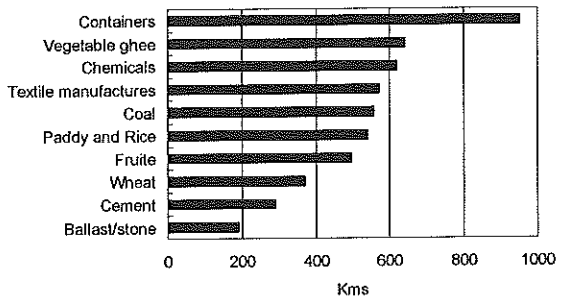
Freight traffic volume was estimated at 305 million ton-km/day, and passenger traffic volume was estimated at 401 million passenger-km/ day. From this estimation, the yearly freight traffic volume worked out to be 101 billion ton-km (BTK), while passenger volume was at 132 billion passenger-km. Since PTPS Traffic Survey did not catch all the O/D pairs, the estimated transport volume does not represent the total traffic volume in Pakistan. The estimated values are less than the traffic forecast in MTDF.

3-10. Freight Transport





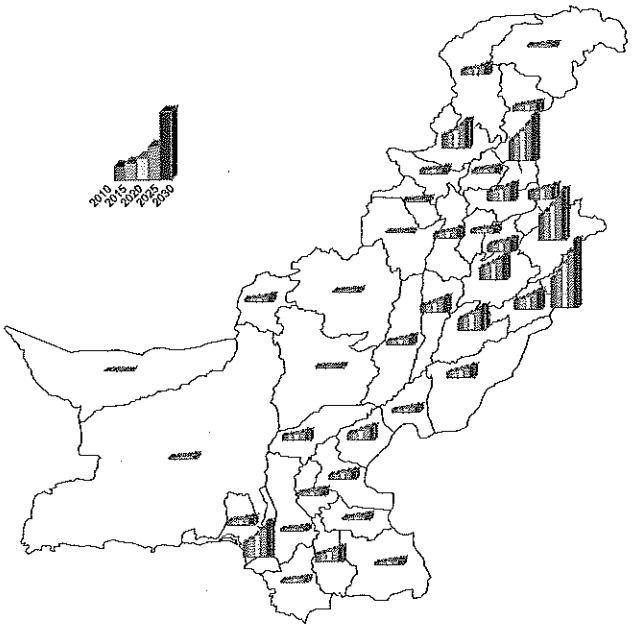
Major commodities carried by trucks are: 1) Ballast, gravel, stone; 2) Cement; 3) Fruit; 4) Wheat; 5) Fertilizer, and so on. Freight transport in terms of ton-km was calculated using a distance matrix. The average trip length of container was high at 950 km, while that of ballast/ gravel/ stone was low at 190km.



4. Demand Forecast

4-1. Vehicle Trip Forecast

Basic Assumption:
- Vehicle trip from/to each TAZ will increase at the same growth rate of GDP.
- Modal share between Road and Rail will be the same.
- International freight will increase at the same rate of GDP of Pakistan.
- The future O/D Matrix is estimated by fratar method.



The future vehicle trip

Traffic Growth Ratio of TAZ

TAZ	2005	2010	2015	2020	2025	2030
1	1.00	1.43	2.00	2.70	3.64	4.68
2	1.00	1.35	1.77	2.25	2.86	3.46
3	1.00	1.42	1.97	2.65	3.54	4.53
4	1.00	1.38	1.86	2.41	3.13	3.88
5	1.00	1.39	1.90	2.49	3.26	4.09
6	1.00	1.39	1.90	2.49	3.27	4.09
7	1.00	1.40	1.92	2.54	3.36	4.24
8	1.00	1.43	2.00	2.69	3.63	4.67
9	1.00	1.35	1.79	2.29	2.92	3.56
10	1.00	1.36	1.80	2.31	2.96	3.62
11	1.00	1.35	1.78	2.27	2.89	3.51
12	1.00	1.36	1.80	2.30	2.93	3.58
13	1.00	1.39	1.88	2.46	3.22	4.03
14	1.00	1.39	1.89	2.48	3.25	4.07
15	1.00	1.38	1.85	2.40	3.11	3.85
16	1.00	1.44	2.01	2.72	3.68	4.75
17	1.00	1.38	1.87	2.44	3.17	3.95
18	1.00	1.44	2.03	2.75	3.74	4.84
19	1.00	1.44	2.03	2.75	3.74	4.84
20	1.00	1.40	1.90	2.51	3.30	4.15
21	1.00	1.40	1.93	2.56	3.39	4.29
22	1.00	1.43	2.01	2.71	3.66	4.72
23	1.00	1.36	1.80	2.30	2.94	3.58
24	1.00	1.44	2.02	2.73	3.69	4.76
25	1.00	1.36	1.79	2.29	2.92	3.55
26	1.00	1.36	1.82	2.34	3.01	3.69
27	1.00	1.37	1.83	2.35	3.02	3.70
28	1.00	1.39	1.87	2.45	3.20	3.98
29	1.00	1.42	1.96	2.62	3.49	4.43
30	1.00	1.38	1.87	2.43	3.16	3.93
31	1.00	1.39	1.89	2.48	3.24	4.05
32	1.00	1.41	1.95	2.59	3.43	4.35
33	1.00	1.39	1.89	2.47	3.23	4.03
34	1.00	1.40	1.92	2.54	3.34	4.21
35	1.00	1.45	2.05	2.80	3.82	4.97
36	1.00	1.36	1.80	2.30	2.95	3.59
37	1.00	1.40	1.90	2.50	3.28	4.11
38	1.00	1.37	1.83	2.36	3.03	3.73
39	1.00	1.37	1.84	2.37	3.06	3.77

Increase of Vehicle in Pakistan

(1000units)

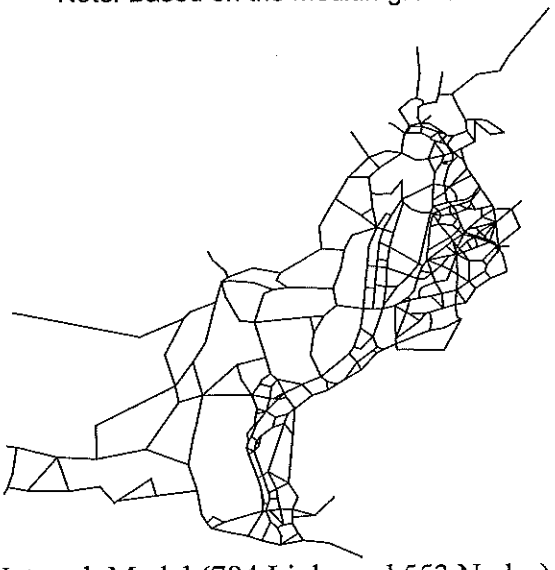
	Car	Bus	Truck
2005	2003	120	280
2015	4852	197	450
2025	9303	263	596

Note: Based on the mediun-growth scenario

4-2. Network Model

The future road network data were prepared for Traffic Assignment Model. The network data consists of 784 links and 553 nodes, and each link data has a speed-flow relationship model.

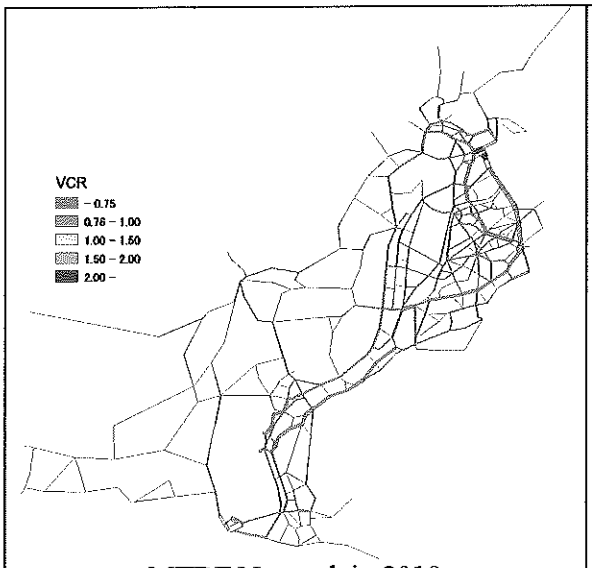
The estimated future O/D Matrices were assigned to the future road network data.
The method of the traffic assignment is User Equilibrium and Fixed Demand Model.



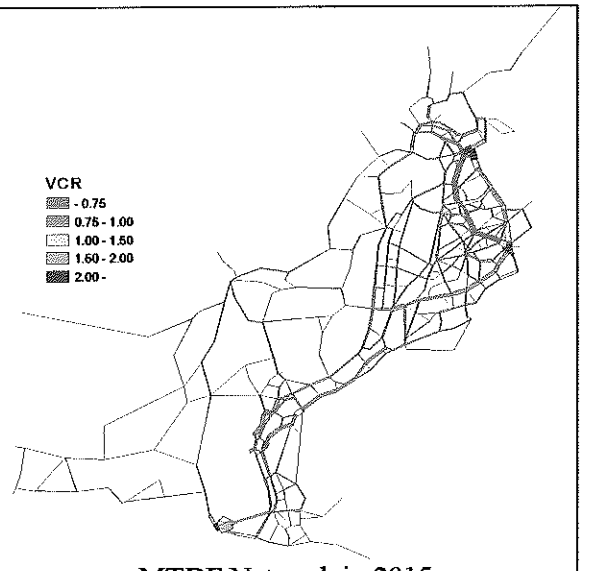
Network Model (784 Links and 553 Nodes)

4-3. Traffic Assignment

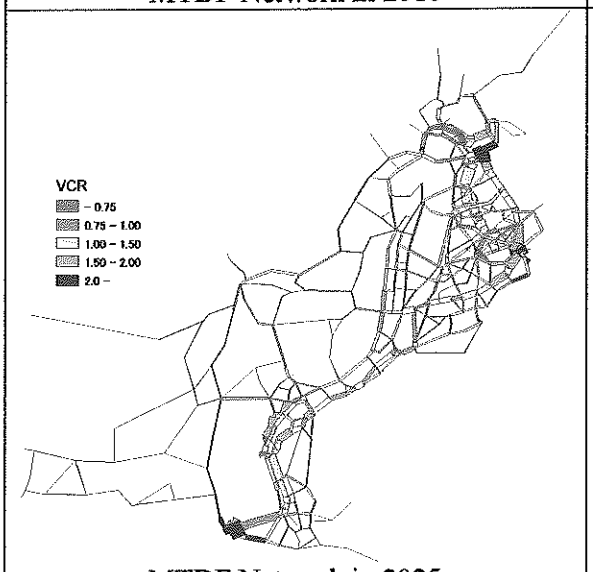
- Traffic Assignment shows that the MTDF Network will be able to provide good service level for the future traffic demand in 2010.
- The network will have enough capacity until 2015, although the service level will become low along some corridors like N-5 (Islamabad-Lahore - Shahiwal) and N-55 (D.GKhan-Dadu).
- If MTDF will not be achieved up to 2015, serious congestion will arise along N-5 and N-55 in Sinde Province.
- The MTDF Network is insufficient to deal with the future traffic demand in 2025.



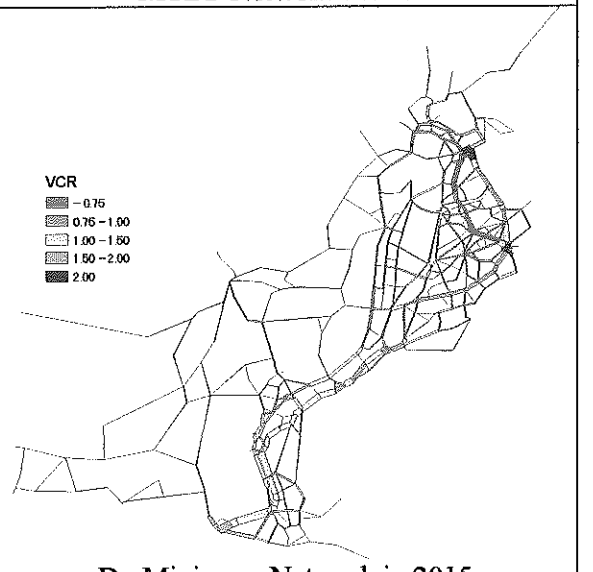
MTDF Network in 2010



MTDF Network in 2015



MTDF Network in 2025



Do Minimum Network in 2015

5 Future Road Network

5.1 Growth in Travel Demand

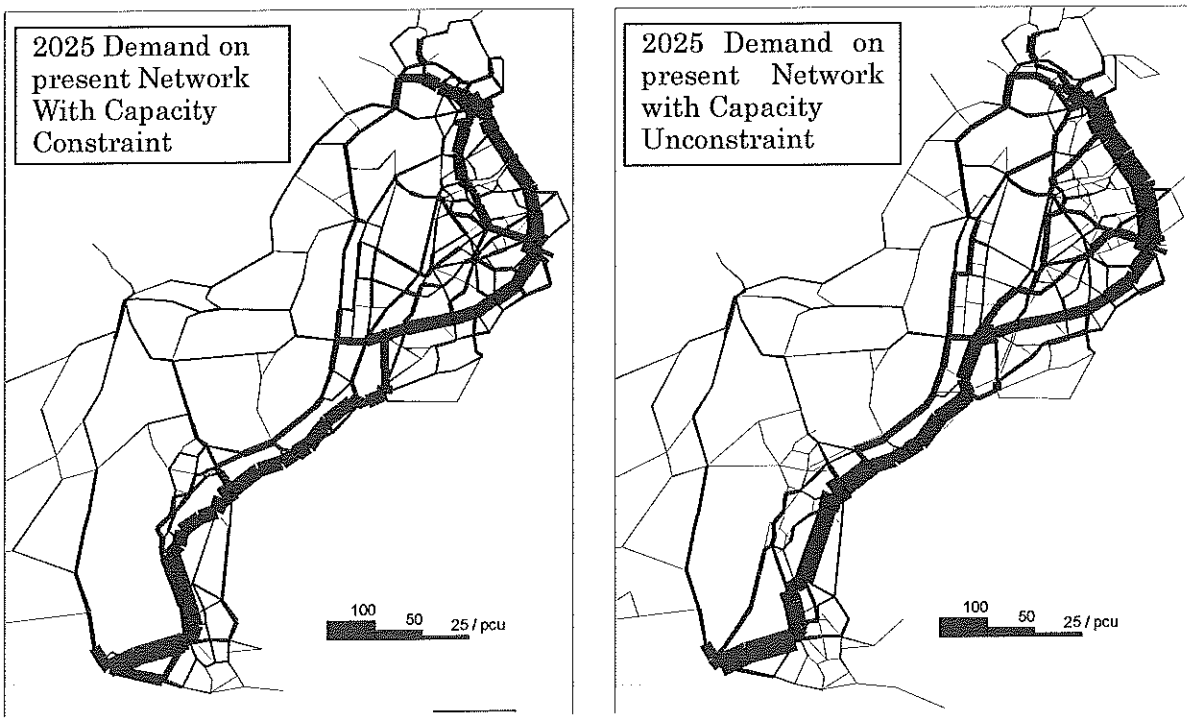
- Forecast growth in travel demand to 2025 is expected to be more than 3-fold,
- Growth rate is expected to be higher in the Ist decade than in the following 10 years, and the demand for both freight and personal travel by road is expected to double over the next ten years.

Table 5.1 Growth of Transport Demand

Year	Passenger or ton (mill./yr)			Pax-km or ton-km (bill./yr)		
	2005	2015	2025	2005	2015	2025
Passenger	711	1366	2390	133	263	479
Freight	273	526	922	102	202	364

The figures below show network capacity constrained and unconstrained forecast travel patterns on Pakistan highway network in 2025. The network constrained demand patterns show a considerable diversion to longer highways. Whereas, in an unconstrained scenario, the diversion to shorter routes is limited. This illustrates that the average trip length on the network is short, and opportunities to divert on to shorter routes are limited.

Figure 5.1 Assigned Traffic of 2025 Demand on Current Network

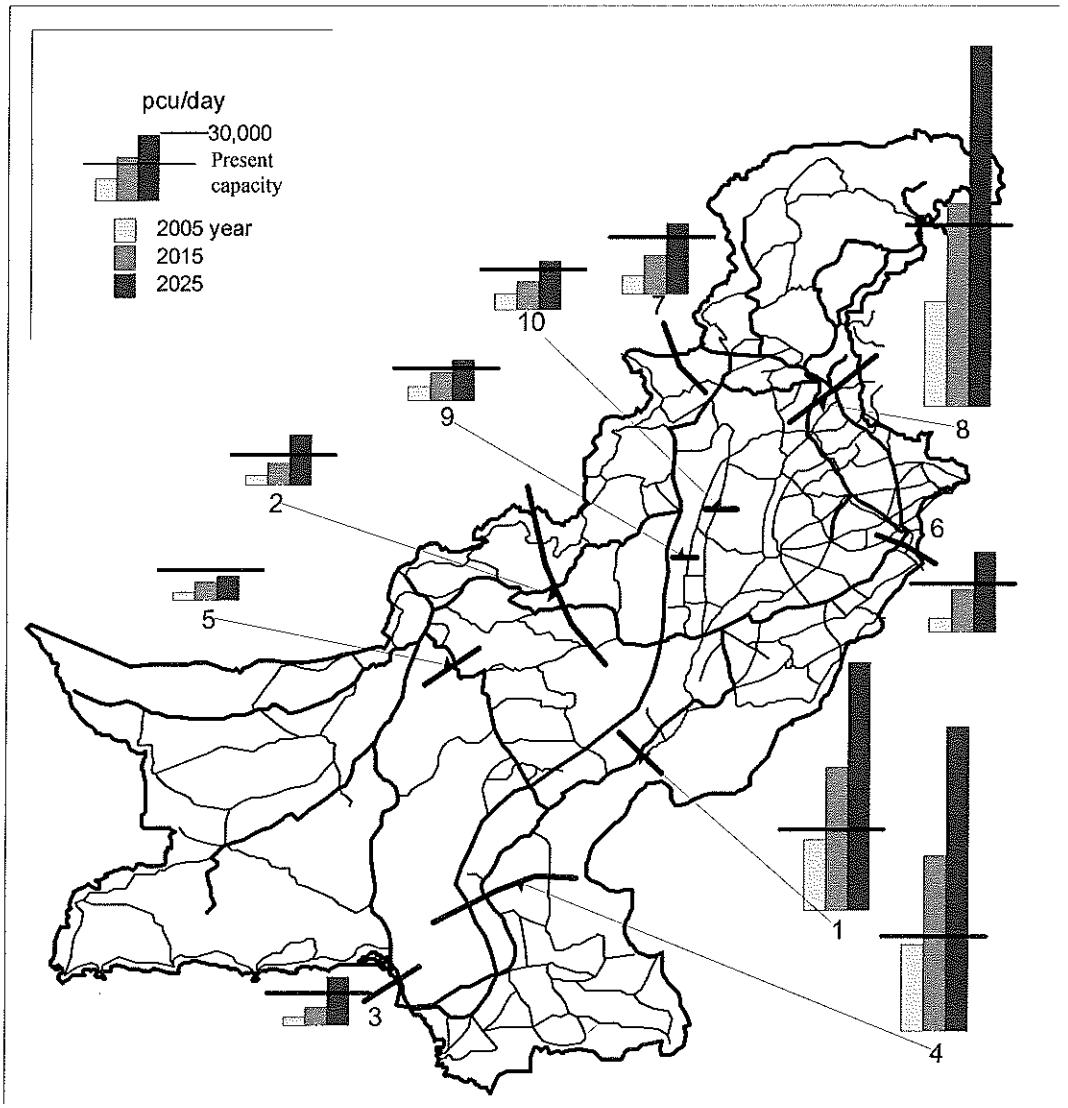


5.2 Corridor Analysis

Figure below depicts the travel demand for 2005, 2015 and 2025 by three histogram bars, and the cross line defines the current capacity along each corridor. The analysis across 10 major corridors in Pakistan illustrates that:

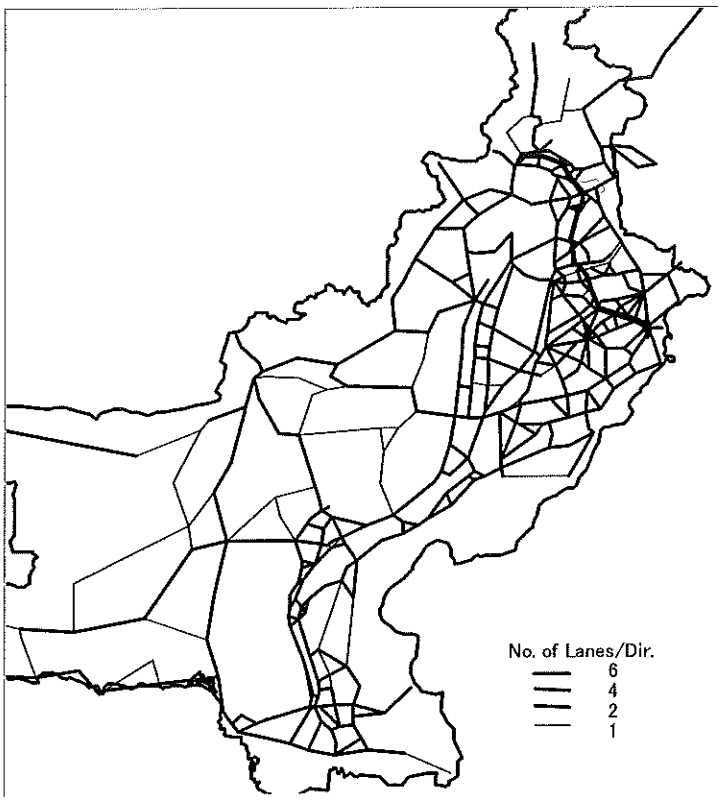
- All corridors west of Indus have sufficient capacity to 2015, but four corridors out of five would need additional capacity to meet the projected 2025 demand.
- The scenario to the east of Indus reflects that the current network capacity would only be sufficient for the next five years or so. Beyond that additional capacity is essential, and on three out of four corridors the additional capacity requirement is more than double the current capacity.

Figure 5.2 Demand and Supply Gap on Screen Lines



5.3 On-going and Committed Projects

Figure 5.3 Road Network after current projects

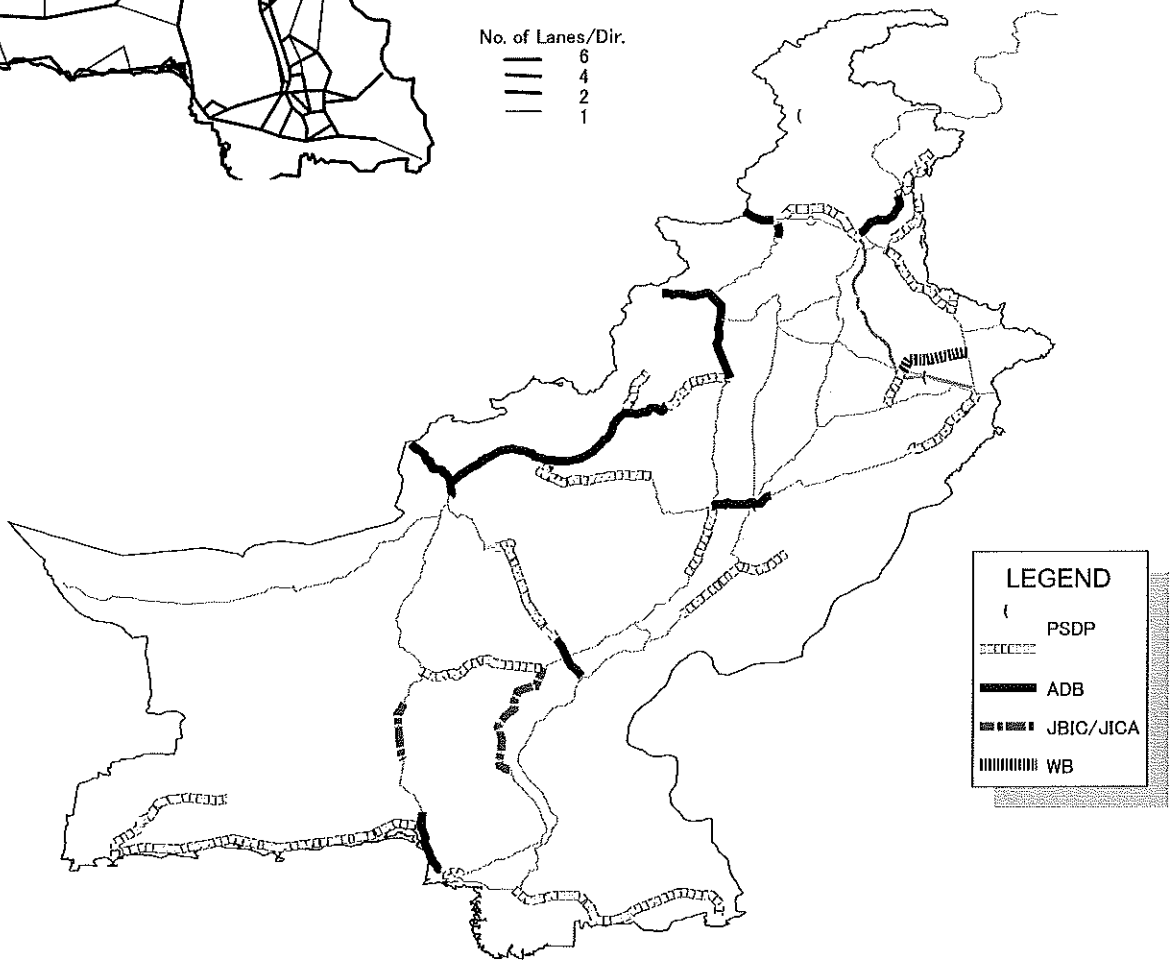


Currently there are a number of infrastructure projects being carried out. Figure below shows these by donor agencies.

After completion of all the committed schemes highway network would be as illustrated in Figure on the left by the number of lanes.

It is clearly noticeable that after such a large development program most of the network is either 1 or 2 lane wide, and the dual-2 or dual-3 roads are still very limited.

Figure 5.4 Current Projects



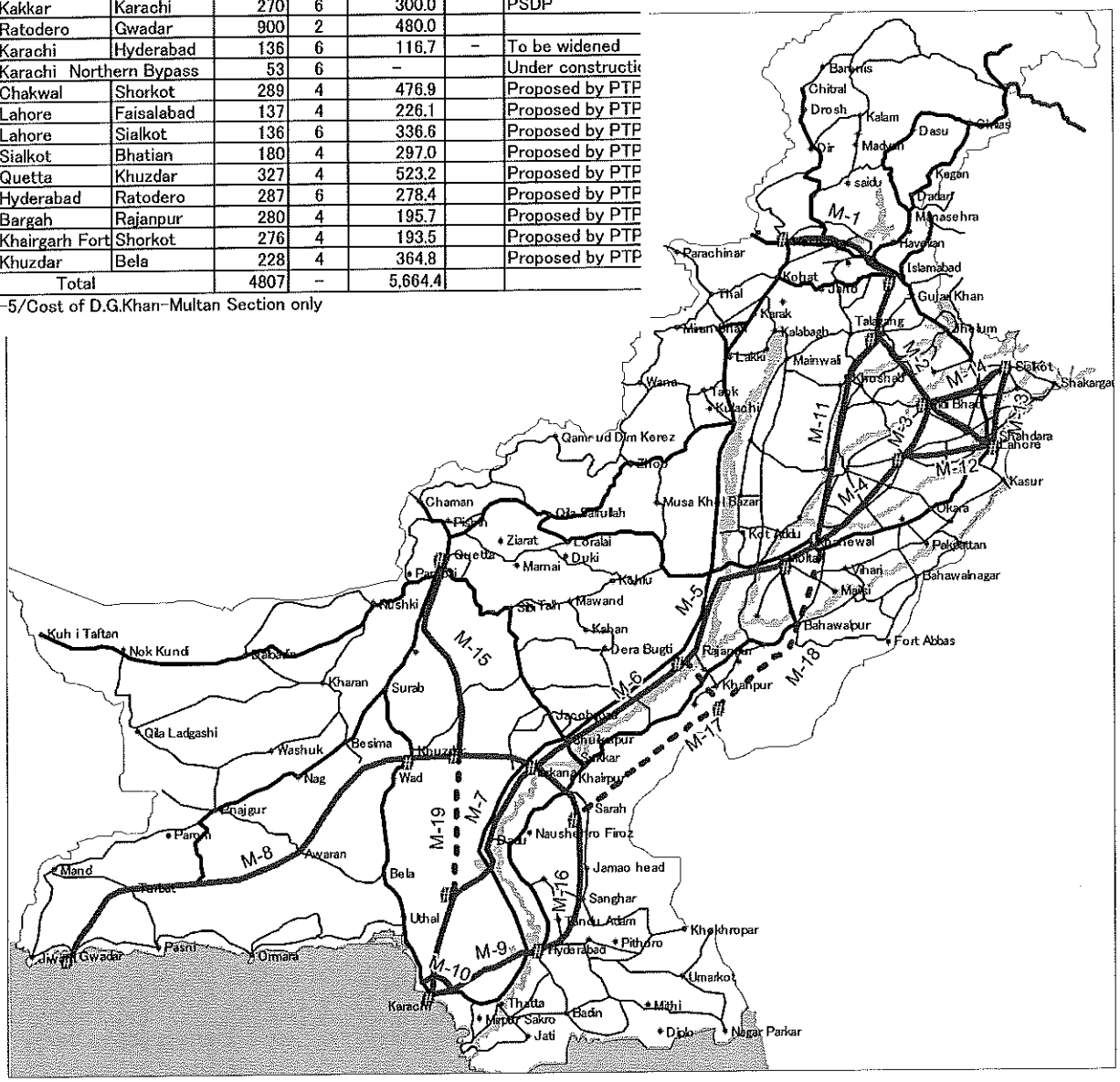
5.4 Pakistan Motorway Network

The table and figure below detail the current, committed, and indicative motorway network of Pakistan, as modeled by PTPS. The network development has two salient features: 1) It diversifies the demand away from the current single N/S corridor of N5, and 2) in case of failure of one corridor, the alternative routes could be used effectively.

Code	From	To	Distance (km)	No.of Lane	Cost (US$million)	Const. period	Remarks
M-1	Islamabad	Peshawar	155	6	447.7		On-going
M-2	Lahore	Islamabad	367	6	–	–	Existing
M-3	Faisalabad	Bhatian	53	4	–	–	Existing
M-4	Faisalabad	Multan	243	4	368.0		BOT/PPP
M-5	Multan	Rajanpur	220	4	700.0		BOT/PPP(ADB)
M-6	Rajanpur	Ratodero	270	6	360.0		PSDP
M-7	Kakkar	Karachi	270	6	300.0		PSDP
M-8	Ratodero	Gwadar	900	2	480.0		
M-9	Karachi	Hyderabad	136	6	116.7	–	To be widened
M-10	Karachi Northern Bypass		53	6	–		Under constructi
M-11	Chakwal	Shorkot	289	4	476.9		Proposed by PTP
M-12	Lahore	Faisalabad	137	4	226.1		Proposed by PTP
M-13	Lahore	Sialkot	136	6	336.6		Proposed by PTP
M-14	Sialkot	Bhatian	180	4	297.0		Proposed by PTP
M-15	Quetta	Khuzdar	327	4	523.2		Proposed by PTP
M-16	Hyderabad	Ratodero	287	6	278.4		Proposed by PTP
M-17	Bargah	Rajanpur	280	4	195.7		Proposed by PTP
M-18	Khairgarh Fort	Shorkot	276	4	193.5		Proposed by PTP
M-19	Khuzdar	Bela	228	4	364.8		Proposed by PTP
Total			4807	–	5,664.4		

Note: M-5/Cost of D.G.Khan-Multan Section only

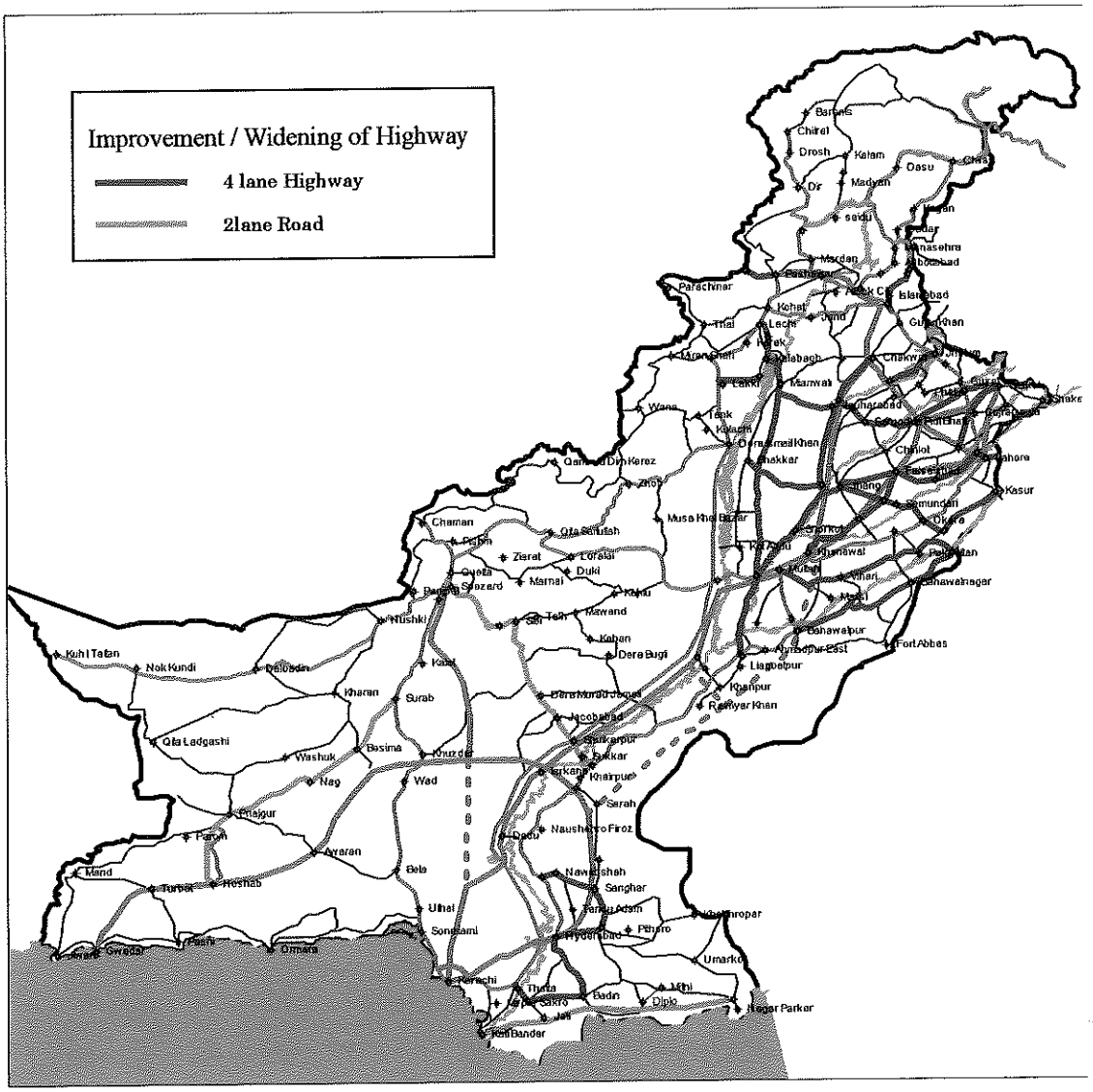
Figure 5.5 Motorway network



5.5 Highway Network

By 2025, many highways will need widening into dual-2 carriageway due to heavy demand exceeding present capacity, especially in Punjab province. Figure 5.5.5 shows the highways to be widened and improved. They will be examined concerning to their economic viability and appropriate timing of implementation in the evaluation stage.

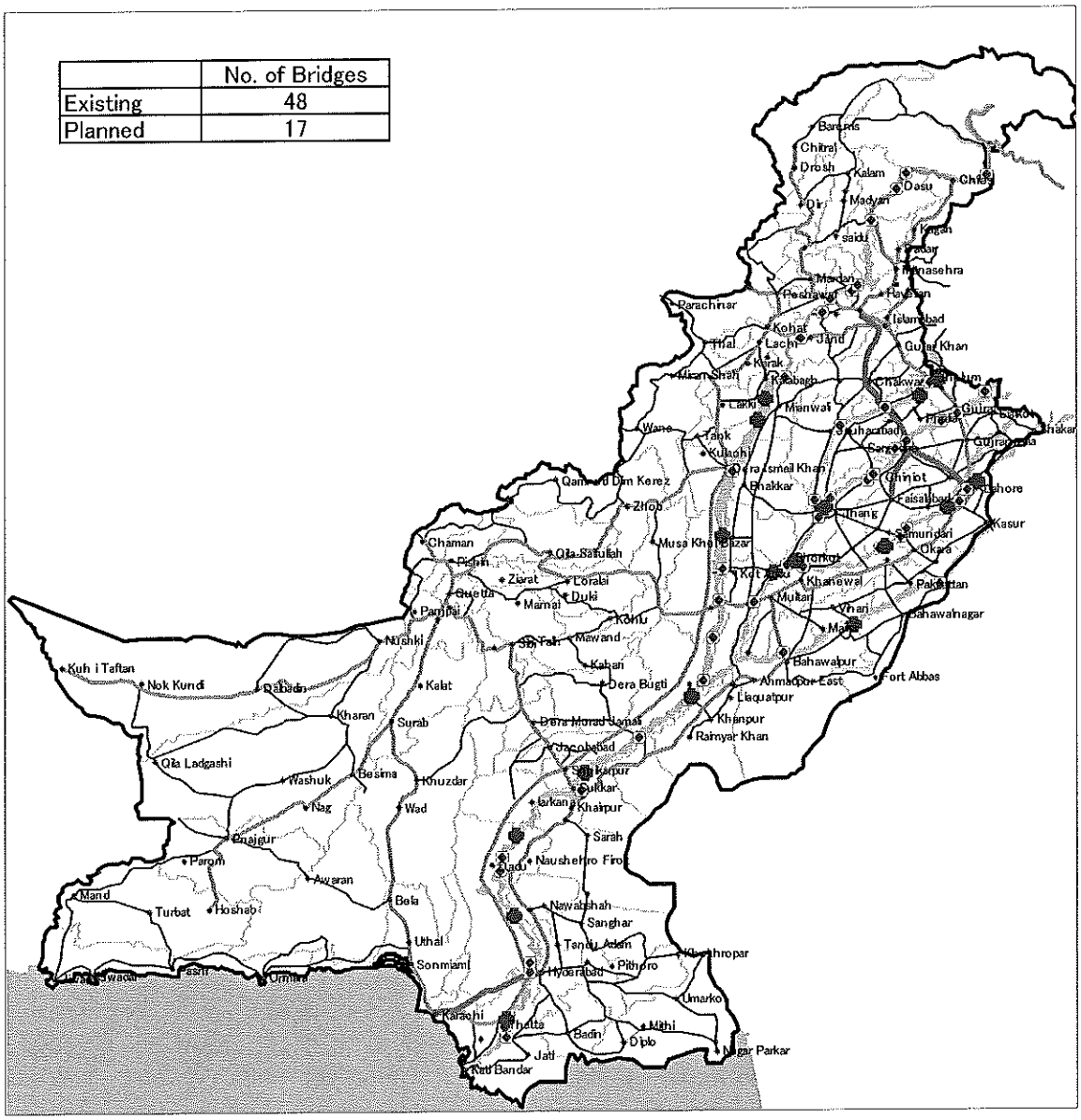
Figure 5.6 Highway Improvement and Widening Plan



5.6 Cross River Development

The density of bridges over the vast network of rivers of Punjab could be considered, to be low for such a populous area by any standards. This is particularly true for river Indus. In order to improve the cross-river interaction of communities for more balanced regional growth and increased flow of goods, WB is currently studying nine candidate locations to select four sites for new bridges. In addition provincial authorities have also indicative plans to enhance cross-river community interaction by proposing nine bridges in Punjab province for implementation in the medium to long term future.

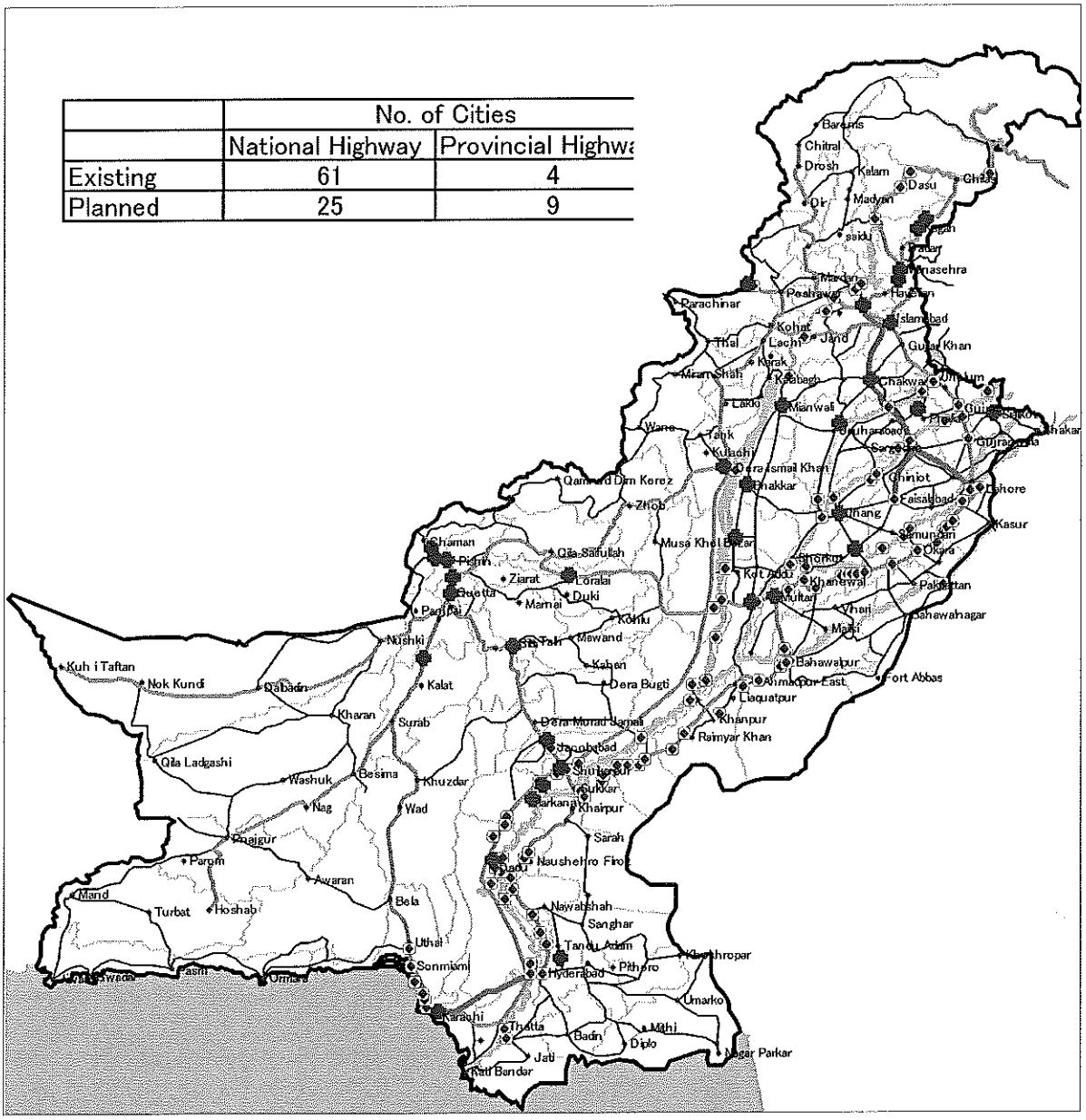
Figure 5.7 Existing and Proposed Bridges



5.7 Bypass Schemes

Most medium to small cities of Pakistan have developed along the major arterial roads. In almost all cases the development has been gradual from small town to large town, and medium size city to large city, just growing totally unplanned as ribbon development. The increase in road space had hardly kept pace with the growth in communities. To alleviate the traffic congestion, bypass schemes have been implemented in a number of cities, and numerous new schemes have been planned. The densities of by passes in the figure below illustrate the insatiable need for such highway schemes. This is also considered a quick fix to major traffic problems.

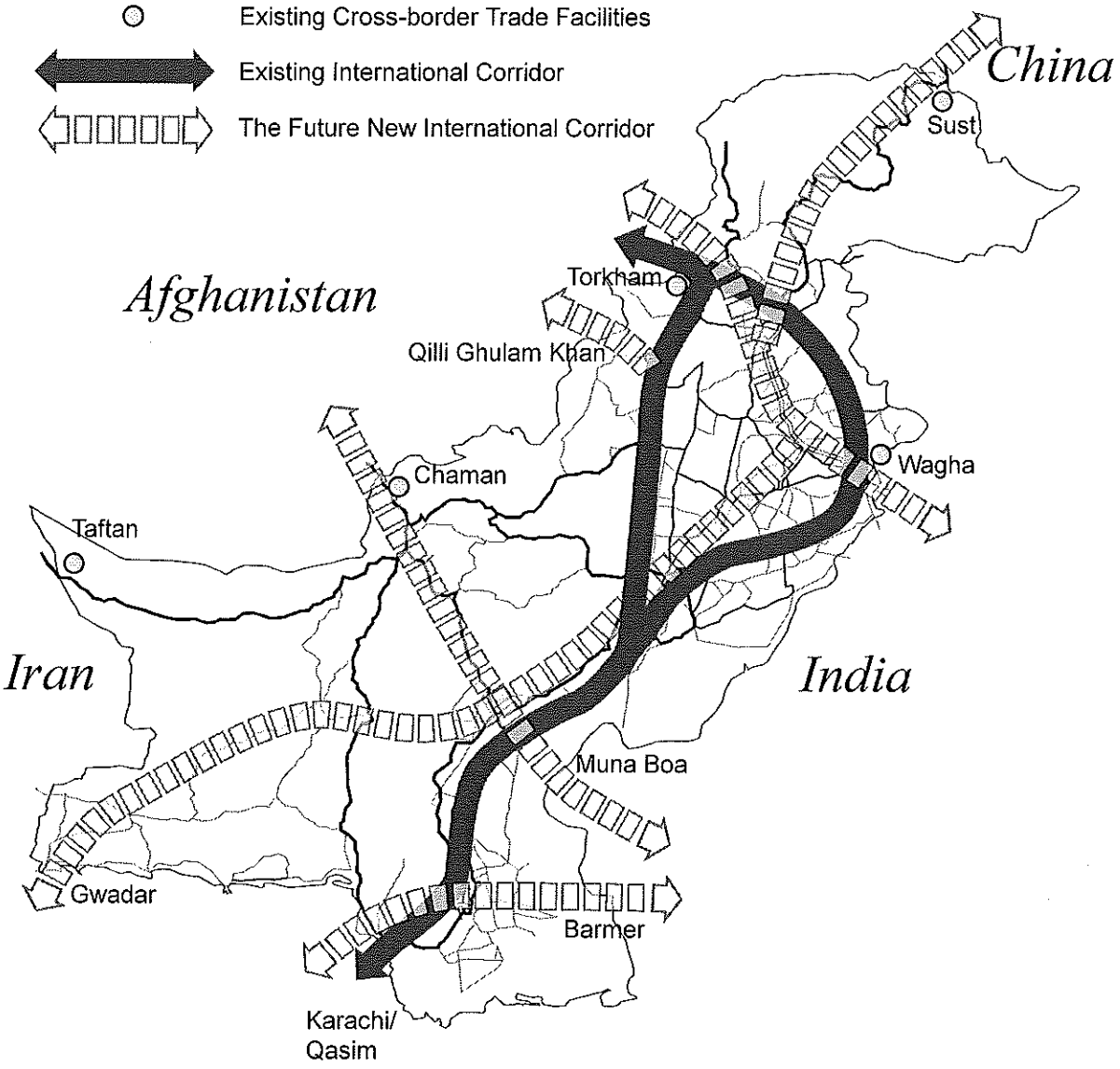
Figure 5.8 Location of Existing and Proposed Bypasses



5.8 Cross Border Transportation

- Current cross border facilities are at 5 locations for access to all 4 neighbouring countries.
- Trade with Afghanistan accounts for about 10% of their GDP, and is larger than the other three neighbouring countries
- Current facilities and system of processing trade goods and passengers are rather antiquated, and are in dire need of modernization.
- Facilities at Wagha are comparatively better, but the trade is limited, as the political atmosphere still needs improvements for open trading

Figure 5.9 Corridor Development of Cross Border Routes



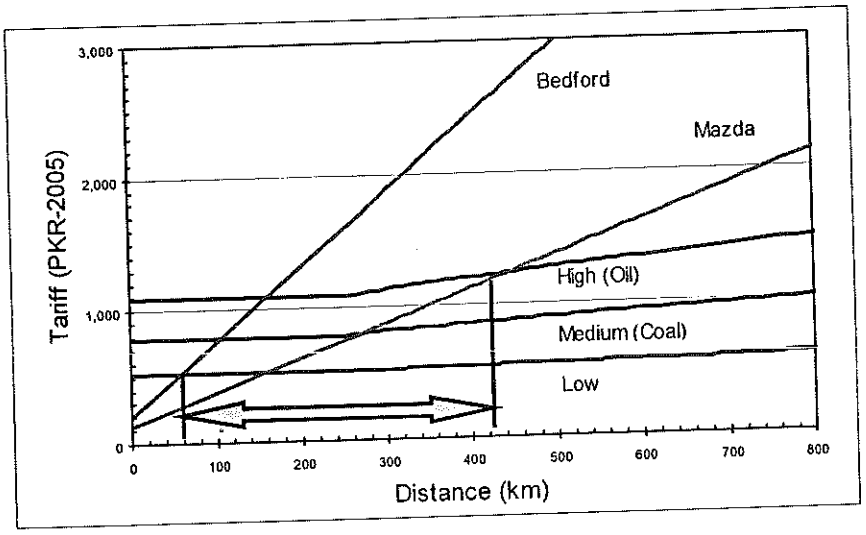
- Volume of trade by road to all countries is small, and the current access road capacity is adequate for the medium term future
- However, due to euphoria of future trade links with Central Asian States GoP has taken action, and
- Facilities are at Torkham are being upgraded under contract to NHA,
- Access road to Torkham via Khyber Pass is planned to be dual-2 (Committed by ADB?). Current cross border traffic volume is around 400~500 vehicles per day.
- Access road to India (Historic G T Road) through Wagha is currently being upgraded from a single carriageway to dual-2. However, it would need additional planning

6 Strategic Modal Share between Road and Railway

6.1 Tariff

Over 440km, railway tariff is advantageous for all kinds of commodities, even including loading and unloading charge.

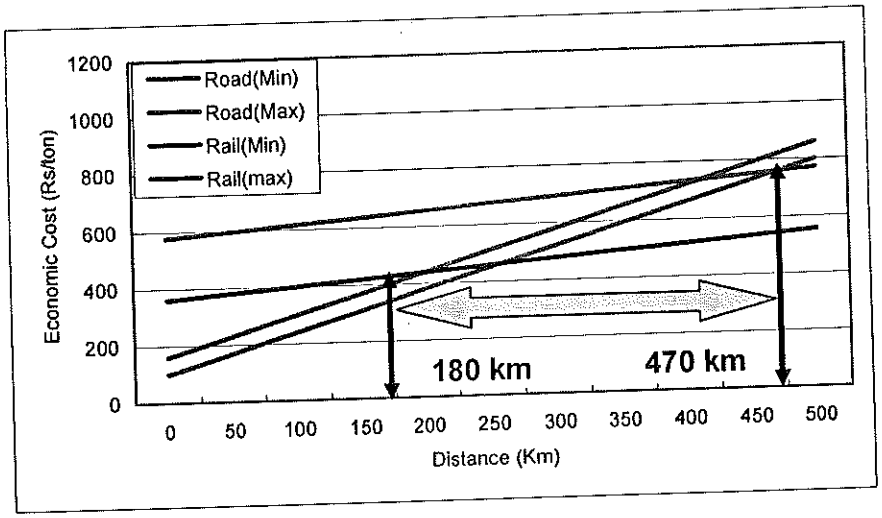
Figure 6.1 Tariff of Truck Tariff and Railway Tariff



6.2 Economic Cost

In terms of economic cost inclusive of construction and maintenance cost of infrastructure, distances between 180- 470 km are competitive range.

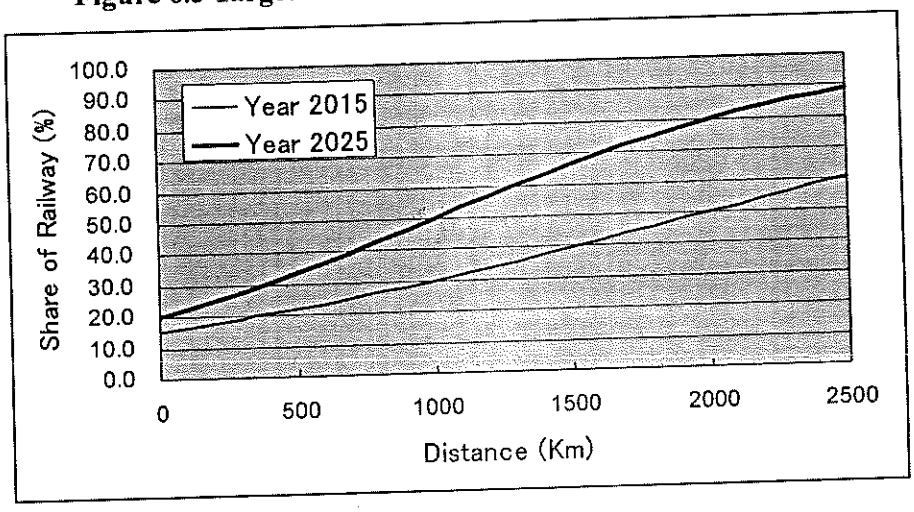
Figure 6.2 Economic Cost of Truck and Railway Transport



6.3 Target Share of Railway

Assuming some 50% of railway's share of railway at 1000km and 80% at 2000km in year 2025, a target conversion curve was obtained as shown in Figure 6.3. On the way to 2025, 30% at 1000km and 50% at 2000km were targeted for the year 2015.

Figure 6.3 Target Conversion Curve from Road to Railway



Using the conversion curve, future railway demand was estimated as shown in Table 6.2. In terms of ton-km, railway freight should grow over thirty times by 2025, by raising its share from 5% at present to 40% in 2025.

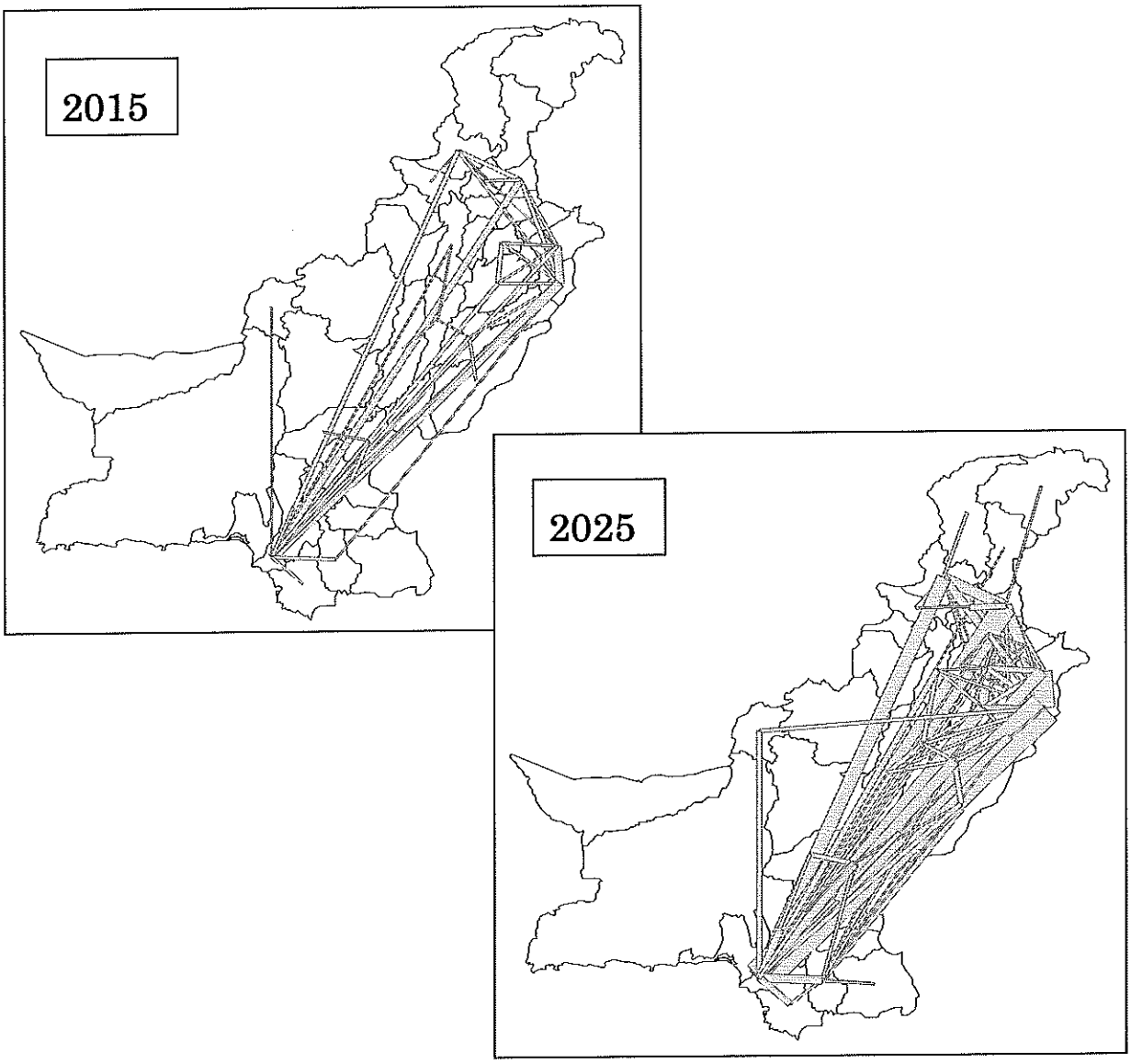
Table 6.2 Future Potential Demand of Railway

Mode	Freight Volume (million ton/Year)			Transport Vol. (billion ton-km/year)		
	2005	2015	2025	2005	2015	2025
Total	273	526	922	102	202	364
Road	267	429	666	97	153	219
Rail	6	97	257	5	49	145
	Composition (%)			Composition (%)		
Total	100.0	100.0	100.0	100.0	100.0	100.0
Road	97.7	81.6	72.2	95.1	75.8	60.2
Rail	2.3	18.4	27.8	4.9	24.2	39.8

6.4 OD Structure of Railway Freight

Figure 6.4 shows the future freight OD of railway in a shape of desired line. As the result of target demand setting, long-distance freight transport lines are remarkable, such as between Karachi and northern cities of Lahore, Islamabad/Rawalpindi, and Peshawar.

Figure 6.4 Desired Line Chart of Freight Transport of Railway



7. REFORM AND DEVELOPMENT OF PAKISTAN RAILWAYS

7-1. Introduction

Pakistan Railways (PR) can complete the transition from publicownership to private ownership. Lessons learned from the international experience, however, reveal that financially troubled railways are difficult to sell "as is".

To complete the final transition of ownership the value of PR assets must be enhanced. This calls for a multi-stepped and coordinates reorganization.

Management reform alone can not improve operating performance vis-à-vis labor and capital productivity. The financial viability of the PR is dependent on its train operation capacity and contestability. If the institutional and management reform is not carried out without the development of infrastructure, rolling stock and service facilities the risk of the government that might be called upon to renew financial support increases.

It is, therefore, imperative for the government to prepare a plan of action with a time table for the ultimate transition.

7-2. GOP's Objectives and Reasons for PR Restructuring

(1) Transform PR into a commercially oriented entity: .PR is under-achieving its considerable potential. The internal structure of the core railway business is monolithic and uncommercial.

(2) Attract private sector capital into industry: Total budgetary allocations for the railway is still disproportionate to its role. There is insufficient investment in PSDP for infrastructure and rolling stock and train service to face with the growing Private capital into railway and rail support industries and train operations are minimal.

(3) Introduce contestability into rail service delivery. Freight transport capacity has declined to the lowest level, despite a growing total freight market, and, subsequently, traders are forced to pay higher road costs because of the poor rail services. PR's concentration on the prime user (passenger services) has adversely impacted on freight business.

7-3. Historical Perspective of PR Privatization

(1) 1996 GOP published an : Open Access Policy(OAP):The goal of the GOP was to Build the railway industry's commercial capabilities and reputation for quality services. GOP solicited private sector bids to transport fuel oil by rail on behalf of Pakistan State Oil (PSC) to upcountry private power stations. There was no positive reaction from the private sector.

(2) 1997 GOP announced its strategy for PR Privatization: PR will be restructured Into three core business (passenger, freight and infrastructure). The core businesses will be corporatized and privatized, and all surplus assets, including non-core businesses, real estate, and liabilities are retained by a new Railway Settlement Agency. The GOP plan created negative impacts on the PR administration and development of management and infrastructure.

(3) 2004 GOP focused on the commercialization and corporatization of PR

7-4. Pakistan Railways Corporation Act, 2005

- **Creation of a wholly owned public corporation that may be called the Pakistan Railways Corporation(PRC);**
- **Installment of new Board which consists of Chairman, CEO, and nine directors, namely, three from the GOP, three from PRC and three from private sector.**
- **The Board has the power and authority to make decisions and administer the affairs of PRC, including the determination of tariffs and rates at which PRC will provide Railway service;**
- **Transfer all non-core activities, i.e. schools, hospitals, to a new holding company to be created under the Ministry of Railways;**
- **Transfer of all assets, rights, powers, authorities, privilege, properties, movable and immovable, cash and bank balance to the new Corporation;**
- **Transfer of all debts/loans or overdrafts and all liabilities, i.e. pension, post retirement benefits and general provident fund transferred to GOP;**
- **Development, improvement and rehabilitation of railway fixed infrastructure and rolling stock remain the responsibility of GOP as part of PSDP;**
- **Costs of uncommercial passenger services/routes are compensated by GOP as Public Service Obligations or defense requirements.**

7-5. Rationale of the Management Reform

(1) Creation of a Commercially Oriented Railway

- The institutional structure of PR contains weak incentives to increase efficiency.
- PR cannot be an effective player in a competitive transport market while it is a government department. Such structures suppress commercial incentives, distort business and investment decisions and sap management responsibility and accountability;

(2) Creation within PRC of Lines of Business Management

- Lines of business management facilitates greater management responsibility and accountability(equals better performance)
- Lines of business management enables profit centre accounting, hence better performance monitoring
- Lines of business management simplifies and focuses marketing and business development functions

(3) Curtailment of Non-core Activities

- Non-core activities create management complexity, divert attention also create an excuse for high costs
- Ownership of supply industries prevent the benefits of competitive tendering and the rigor of normal commercial supplier contracts
- Non-core activities absorb scarce railway investment

(4) Financing Structure and Self-sufficiency in Train Operation

- The financing structure is *ad hoc* and unsustainable
- With no clear long-term strategy or shot-term goal and no value for money test, or monitoring to underpin budgetary support
- Such systems also create few incentives for management to focus on net costs rather than gross revenue and expenditure separately

(5) Curtailment of Surplus Employees

- Overstaffing encourages sloppy management and poor staff moral, as well as higher costs

7-6. Transport Capacity of Pakistan Railways

- Passenger transport: According to the Economic Survey 2004-05 the total passenger traffic in 2004-05 was 189,778 million passenger-km/year and the share of railway was 9.5%

- PR's freight traffic has declined to a low level, despite the growing total freight volume in the country. According to the Economic Survey 2004-05 the total freight transport volume in 2004-05 was 90,658 million ton-km/year and the share of railways was 4.21%.

- Targets for total freight volume and transport volume and those by two key modes of land transport were established by JICA Study Team and shown below.

- According to the JICA Study forecast a total freight volume in 2015 and 2025 are 525 million ton/year and 922 million ton/year, respectively. Total freight transport volume in 2015 and 2025 are 202 billion ton-km and 364 billion–ton/year, respectively.

- The freight transport volume by rail in 2015 and 2025 are 153 billion ton-km/year and 219 billion to-km/year in 2015 and 2025.

- According to the JICA forecast a total freight volume will reach 922 million ton/year of which 257 million ton/year or 18.4 % by rail.

- The total transport volume, on the other hand, is 202 billion ton-km and 364 billion ton-km/year in 2015 and 2025, respectively. The share of the rail is 49 billion ton-km/year and 145 billion to-km/year in 2015 and 2025, respectively.

Mode	Freight Volume (million ton/Year)			Transport Vol. (billion ton-km/year)		
	2005	2015	2025	2005	2015	2025
Total	273	526	922	102	202	364
Road	267	429	666	97	153	219
Rail	6	97	257	5	49	145
	Composition (%)			Composition (%)		
Total	100.0	100.0	100.0	100.0	100.0	100.0
Road	97.7	81.6	72.2	95.1	75.8	60.2
Rail	2.3	18.4	27.8	4.9	24.2	39.8

Source: JICA Study Team

7-7. Improvement of Freight Transport Capacity

Diagnosis of the Existing Conditions of Infrastructure and Rolling Stock

(1) Delay of track rehabilitation on the Karachi-Lahore Main Corridor: Delay in track rehabilitation works of main corridor (Karachi-Lahore) and slow progress of the works on other sections which are located where works are carried out sporadically.

(2) Insufficient Operation Speed: Actual maximum speed of 95-105 km/hr may meet the main corridor's immediate requirement for train operations but it is not sufficient for sustainable operation of railway.

(3) Double Track section is only 1,043 Km out of 7,791 route-kilometers: Double track section is only 1,043 km in total out of 7.791 rout-kilometers. Most of the double track sections belong to the most important sections (Karachi-Lahore1, 219km). The track dualization works between Lodhran and Khanewal via Multan are under construction for its completion in 2005/06

(4) Single track still remain in the heaviest traffic sections, between Khanewal-Raiwind 245 km: The scheduled speed is forced to be reduced in this section because trains must wait to exchange, and delays are amplified in this section by unexpected waiting resulting the prevention of effective use of other sections.

(5) Obsolete Signaling systems and insufficient automatic block System: Automatic Block System (ABS) is installed only in a limited section of 178 km, between Karachi and Hyderabad, out of 7,791 km of railway network. The system is not installed even on the double track sections. Most of the signals other than the ABS are semaphores which are dim, difficult to be recognized in the night and require frequent maintenance.

(6) Obsolete Communication systems. PR is equipped with train radios which are working but they are obsolete. Current telecommunication system is inadequate for sustainable railways and early improvement is essential.

(7) Bridges requiring rehabilitation: Some of them are requiring rehabilitation and continuous inspection and repairing.

(8) Rolling stock: There are not enough reliable and high performance locomotives and few suitable and freight wagons of high performance are in service and there are not enough suitable and attractive passenger coaches.

7-8. Improvement Program

A. Infrastructure

(1) Completion of structural improvement of the Karachi-Lahore main corridor
(2) Renewal and improvement of signaling systems
(3) Renewal and improvement telecommunication systems

B. Rolling Stock and Service Facilities

(1) Replacement of aging rolling stock: Aging rolling stock need to be replaced

(2) Establishment of a high-speed freight transport system: The role of freight railways is limited to high speed, long haulage and massive transport by block trains among selected stations such as large-scale freight stations, dry ports, container centers, logistic centers, etc. to operate by "station-to-station direct transport". Collection and delivery are carried out by automobiles, so labor-saving reloading is inevitable. Therefore, only transport by containers and bulk transport can survive in the motorization age.

(3)Container transport: It is essential to build a container transport system. The system include high power locomotives, high performance wagons, stable infrastructure, suitable container stations at the port side, modern logistic centre in the up-country side, a sophisticated operation and computerized sales system, etc.

(4)Bulk Transport: It is also necessary to build bulk transport system. POL, coal, cement, aggregate, fertilizer and grain will be the main commodity for railway bulk transport.

(5) Operation diagram: In the absence of fair operation diagram and traffic control the freight operations are forced to wait the passenger traffic on the mainline.

First Step (2006-2010)

- **Renewal and Improvement of Signaling Systems**
- **Completion of Track Dualization between Khanewal and Lodhran**
- **Improvement of telecommunication systems(Karachi-Lahore)**
- **Replacement of aging rolling stock(high performance locomotives, freight wagons)**
- **Repair of overage bridges and stations**

Second Step (2010-2015)

- **Improvement /Reinforcement of Peshawar-Lahore section with modernization of signaling and communication systems, track rehabilitation and partial track dualization.**

- Rehabilitation of overage bridges and stations
- Replacement of aging rolling stock
- Establishment of high speed freight transport system(bulk and container);
- Replacement of aging rolling stock, i.e. freight locomotives and modern bogie wagons

Third Step (2015-2025)

- Continuation of the Second step

7-9. Steps Towards Ultimate Privatization and Outline Time Table.

(1) 2015-2020 Conversion of the Operation Business to a Joint Stock Company under the Commercial Law (Code)

(2) 2015-2020 Conversion of Rail Maintenance Business to a Joint Stock Company under the Commercial Law (Code)

(3) 2015-2020 Conversion of Rail Infrastructure to a Joint Stock Company- An Option

(4) 2020-25 Initial Public Offering (IPO) of the above companies.

(5) Establishment of Railway Resettlement Authority-An Option

8. Investment Requirement (Provisional)

Sub-sector	MTDF/PSDP	PTPS (include. MTDF/PSDP)	
	(Rs. Billion)	(Rs. Billion)	(Rs. Billion)
Road	511.0	(*) 1,144.8	(*) 19.1
Railway	111.6	(*) 153.09	(*) 2.6
Port	160.1	166.2	2.8
Airport	135.2	154.2	2.6
Total	917.9	(*) 1,618.2	(*) 27.0

Note: (*) Provisional, and under preparation

Total amount of investment requirement is provisionally estimated at Rs. 1,618 billion or US$ 27 billion including projects of MTDF/PSDP and PTPS. This estimation is still tentative.

9. Evaluation of PTPS Master Plan

9.1 Overall Evaluation of Master Plan Network

(1) Economic Evaluation of Whole Network of Master Plan

Sector		Financial Cost (Rs. mil)	Benefits 2010	Benefits 2025	EIRR (%)	NPV(*) (Rs mil)
Road network	**Evaluation of MTDF new projects**					
	Existing network +On-going ("Without"case) Existing + On-going +MTDF new Projects ("With"case)	234,993	27,737	147,435	19.4%	168,892
	Evaluation of Master Plan					
	Existing & On-going ("Without" case) Existing + On-going + EMTDF new + PTPS ("With" case)					

Prior to evaluation of individual project, economic evaluation was carried out for the whole network

(2) Results and conditions of economic evaluation (provisional)

- **Evaluation of New Projects Proposed in MTDF/PSDP**

1) In the evaluation of Master Plan, on-going/committed projects are taken as granted and treated as the base network (refer to Table below). Whole future road network comprised of existing network, on-going and new projects proposed in MTDF registered **19.4%** of EIRR.
2) Total investment cost is equally allocated between four years from 2006 to 2009.
3) Standard Conversion Factor (SCF) was set at 0.85.
4) All projects are assumed to be opened at the beginning of 2010.
5) Annual maintenance cost after opening is assumed at 2.5% of total investment cost.
6) Benefit of road network is comprised of savings in Vehicle Operating Cost (VOC) and passenger time savings (information of VOC data is given in APPENDIX).

- Evaluation of Road Network proposed in PTPS Master Plan targeted 2025
(Under preparation)

List of Major On-going Projects
(Road and Railway)

NHA Category	Sr No.	PTPS Code	Name of Project	Fund	Estimated Cost (RS. In Million)
1. ROAD					
A	1	10	Makran Costal Road Balochistan	PSDP	15,010.00
A	2	20	Islamabad Peshawar Motorway (M-1)	PSDP	26,862.30
A	3	30	Pindi Bhattian Motorway (M-3)	PSDP	6,876.50
A	4	40	Karachi Northen Bypass	PSDP	2,928.00
A	5	50	Layari Express Way	PSDP	5,081.00
A	6	60	Islamabad -Muzaffarabad Road	PSDP	7,660.00
A	7	70	Indus Highway Project (Phase III)	PSDP	6,556.50
A	8	80	Mansehra Naran Jalkhad Road	PSDP	3,821.00
A	9	90	Hala-Moro Section	PSDP	2,583.00
A	10	100	Rahim YarKhan Bahalwalpur 166 KM)N-5	PSDP	7,283.00
A	11	110	Okara Bypass	PSDP	3,911.80
A	12	120	Kharian Rawalpindi(N-5)	PSDP	5,174.00
A	13	130	Chablat Nowshera (N-5)including flyover at Nowshera Cantt	PSDP	3,700.00
A	14	140	Lowari Tunnel & Address Road	PSDP	7,983.70
A	15	150	Bridgr on River Jhelum at Azad Pattan AJK	PSDP	71.00
A	16	160	Improvement of N-65 Dera Allah Yar Nutal Section	PSDP	771.00
A	17	170	Improvement of N-65 Nutal-Sibi -Dhadar Section	PSDP	1,710.00
A	18	180	Improvement of KKH (N-35) NWFP	PSDP	552.00
A	19	190	D.I.Khan Mughal Kot Section (N-50)	PSDP	1,903.00
A	20	200	Improvement of N-70 Qila Saifullah Loralai Bewata	PSDP	2,841.00
A	21	210	Ratodero-Shahdakot-Khuzdar Section (M-8)	PSDP	1,421.00
A	22	220	Gawadar -Turbat -Hoshab Section (Gawader, Khudar Road (650 km)	PSDP	16,640.00
A	23	230	Khori-Quba Seed Khan Section	PSDP	4,000.00
A	24	240	Realignment of N65 Near Jaccabad & Dera Allah Yar Town	PSDP	477.54
A	25	250	Bridge over River Chenab at Shershah	PSDP	1,023.10
A	26	260	Interchange at Khanqah Dogran on M-2	PSDP	143.87
A	27	270	Interchange at Sial More on M-2	PSDP	74.00
A	28	280	Rehabilitation and Widening of existing road Lala Musa- Gulyana Thotha Rai Bahadur	PSDP	60.00
A	29	290	Nowshera-Chakdara-Dir-Chitral N-45(81Km)	PSDP	1,620.00
A	30	300	Feasibility Studies	PSDP	700.00
					139,438.31
D	45	470	N-5 Rehabilitation Project	PSDP	**19,943.00**
				(WB)	
F	52	540	Kalat- Quetta-Chaman Section of N-25 (247)	ADB	6,671.00
F	53	551	Peshawar-Torkham Dual Carriageway (46 Km)	ADB	12,787.00
F	53	552	Malana junction- Sarai Gambila Dualization (117 Km)	ADB	
F	53	553	Badabher- Dara Adam Khel, Rehab of Existing road (28km)	ADB	
F	53	554	Sarai Gambila-Bannu-Miran Shah-Ghulam Khan (118km)	ADB	
					19,458.00
H	63	650	Kohat Tunnel Access Roads	JBIC	**6,626.70**
L	L8		Karachi Northen Bypass (This project is included in Karachi Northern Bypass (No.4)	PSDP	**1,500.00**
Sub Total (Road)					**186,966.01**
2. Railway					
	R1		Procurement/manufacture of 175 passenger coaches	PSDP	7,776
	R2		Procurement 69 DE locos	PSDP	11,151
	R3		Track rehabilitation and modernization of sleeper factory	PSDP	11,192
	R4		Recommissioning of 55 DE Locos	PSDP	879
	R5		Replacement of breakdown cranes and procurement of relief train	PSDP	407
	R6		1,300 high capacity wagons	PSDP	5,870
	R7		Doubling of track Lodhran - Multan - Kanewal	PSDP	3,297
	R8		Rehabilitation of 450 passenger coaches	PSDP	2,145
	R9		Other projects	PSDP	148
	R10		Strengthening of bridges	PSDP	112
	R11		Underpass at Renala at railway crossing No.147	PSDP	26
	R12		Conversion of Mirpur Khas - Khokhrapar section from metre gauge to broad gauge	PSDP	1,000
Sub Total (Railway)					44,003.00

9.2 Evaluation of Individual Project and Prioritization

(1) Indicators of Criteria for Project Evaluation

1) Economic Indicator
2) Profitability
3) Network Integration
4) International Linkage
5) Social Equity/Poverty alleviation
6) Environment

In order to prioritize individual project in the Master Plan, evaluation criteria above will be applied to each project.

Explanation of each criterion:

(i) **Economic Indicator**: For providing economic bases of implementation of each project. EIRR (Economic Internal Rate of Return) is adopted for evaluation indicator.

(ii)**Profitability:** Possibility of recovering investment cost from revenue-generated projects such as toll roads. In order to reduce the government financial burden, projects which may be implemented under the BOT/PPP bases are also evaluated.

(iii)**Network Integration:** Contribution to strengthen the network. Not only for national trunk routes itself but also to strengthen connectivity of whole transport network.

(iv)**International Linkage:** Contribution to strengthen international linkage to/from neighboring countries focusing on links/gateways on the international routes

(v)**Social Equity/Poverty alleviation:** Contribution to social equity and poverty reduction.

(vi)**Environment:** (a) Impact on Natural Protected Areas: To avoid passing through or near by national parks and Ramsar sites with respect to biodiversity conservation, (2) Impact on Cultural Protected Area: To avoid passing through or near by national monuments and World Heritage Sites with respect to cultural properties protection, and (3) Resettlement: To avoid passing high density residential areas to minimize resettlement.

In the above criteria, only EIRR is estimated quantitatively and qualitative analyses are given to other criteria.

(2) Rating

Rating is carried out considering the size of impact of each project based on the following procedure:

1	Economy	EIRR (%)
2	Profitability	a: Significant b: Limited c: None
3	Network Integration	a: Significant b: Moderate c: Insignificant
4	International Linkage	a: Strong b: Moderate c: None
5	Social Equity/Poverty alleviation	a: Significant b: Less significant c: Neutral/Negative
6	Environment	
7	1) Natural Protected Area 2) 1Cultural Protected Area 3) Resettlement	a: No expected serious adverse impacts b: Expected moderate adverse impacts c: Expected serious impacts
8	Total Evaluation	A: High priority B: Medium priority C: Low priority

Project Evaluation List (Road)
(Under preparation)

No.	ID	Name	Total Cost (M Rps.)	Project Evaluation and Rating								Total Evaluation
				Economic Indicator	Profitability	Network Integration	International Linkage	Social Equity/ Poverty	Environment			
									Natural Protected Area (NP)	Cultural Protected Area (WCH, HIA)	Resettlement	
RD-1	310	Improvement of Quetta Western Bypass	225.5						c	b	b	
RD-2	340	Five Bridges on Gilgit Skardu Road, S-1	214.7						b	a	a	
RD-3	350	Khanki- Dalbegin Section (8K Km) (N-40) Balochistan	1,935.0						a	a	a	
RD-4	360	Jhalkhad- Chitas Road (63 Km) N-15	1,827.3						b	a	a	
RD-5	370	KKH-Skardu Road S-1 (167 Km)	4,000.0						a	a	a	
RD-6	380	Gragger Phatak Bridge to Kohi N-5	2,850.0						b	b	c	
RD-7	390	Jand-Kohat National Highway N-80 (45 Km)	1,000.0						b	a	c	
RD-8	400	Link Road from M-1 GT Road to Hazara Road Bypass ng Hassanabdal P M Directive)	500.0						a	b	b	
RD-9	335	Bridge over River Indus at Larkana	2,500.0						b	a	b	
RD-10	410	Dhakpattan Bridge (P M directive)	520.0						a	a	b	
RD-12	330	Bridge over River Indus at Chund (Bunjir)							a	a	b	
RD-13	420	Other Projects (Interchanges on M-2 Urban Areas Development etc)	3,000.0						b	b	b	
RD-14	450	Widening & Improvement of Hoshab-Nag Bama Surab (459 Km), offered to Iran	12,100.0						a	a	a	
RD-15	460	Karachi-Hub-Dureji-Kalat Motorway (M-7) 270 Km	18,000.0						b	b	c	
RD-16	480	Rehabilitation of 518 Km of N-5	14,610.0						a	a		
RD-17	491	WB Bridge I Between Kotri Bridge and Sukkur Bridge	10,000.0						b	a	a	
RD-18	492	WB Bridge II Between Kotri Bridge and Dadu More							a	a	b	
RD-19	493	WB Bridge III Between Kandhkot and Ghotki							a	a	a	
RD-20	494	WB Bridge IV Rail cum Road Bridge over Indus linking Chashma with Mithankot							a	a	a	
RD-21	495	WB Bridge V Bridge over Indus linking Taunsa and Leiah							a	a	a	
RD-22	496	WB Bridge VI Bridge over Indus at Kalur Kot							a	a	a	
RD-23	497	WB Bridge VII Bridge over Indus linking Mianwali with Isa Khel							a	a	a	
RD-24	500	Intelligent Transportation System (ITS) 7 Corridor Management along the Corridor	6,000.0						a	a	a	
RD-25	830	Rajodero-Rajanpur Motorway Section (M-6), 270 Km	21,600.0						b	a	b	
RD-26	520	Gujranwala-Kharian-Sarai e Alamghir Section N-5 (93 Km) service Road along with Fence	4,200.0						a	a	c	
RD-27	530	Gujranwala-Hafizabad-Pindi Bhattian (100 Km), 4- lane, Motorway link Road	6,000.0						a	a		
RD-28	561	NHDSP I Hub-Uthal Section N25 (85Km)							a	a		
RD-29	562	NHDSP II Multan-Muzaffargarh including Muzaffargarh Bypass (36.2km)							a	a		
RD-30	563	NHDSP III Khanozai-Mughalkot Section N-50 (33Km)							a	a		
RD-31	564	NHDSP IV Hassanabdal-Abbottabad-Mansehra Section N35 (60km)							a	a		
RD-32	565	NHDSP V							a	a		
RD-33	566	NHDSP VI							a	a		
RD-34	567	NHDSP VII							a	a		
RD-35	570	Mahand Tunnel Bypass	6,000.0						a	a		
RD-36	600	Lakpass-Hoshlo Section (120 Km), N-40	3,600.0						a	a	a	
RD-37	640	Improvement of N-65 Quetta-Dhadhar Section (127 Km)	6,350.0						b	b	b	
RD-38	580	National Highway N-45 (Chakdara-Dir, Kalkalak-Chitral) 120 Km	6,000.0						a	b	c	
RD-39	590	Murree- Kohala-Muzaffarabad-Chakothi (S-2)Road N-75, 129 Km	6,000.0						a	a	b	
RD-40	610	Hyderabad-Khokhrapar (222 Km)	8,880.0						a	a	b	
RD-41	620	Chakdara- Kalam Road (130 Km)	6,500.0						a	a	b	
RD-42	630	Khwaza Khela- Besham Road (66Km)	3,300.0						a	a	b	
RD-43	650	Kohat Tunnel Access Roads (OECF)	5,626.7						a	a		
RD-44	690	Rajodero-Sehwan (200 Km) N-55	8,000.0						a	a		
RD-45	670	Widening & Improvement of Kazao-Wad Section N-25 (96 Km) N-25	2,500.0						a	a		
RD-46	660	D G Khan-Sakhi Sarwar-Bewata Section N-70 (165 Km) including Ghazi Ghat Bridge	6,200.0						a	a	b	
RD-47	680	Bridge over River Indus at Khushalgrah (N-80)	3,500.0						a	a	a	
RD-48	700	Rehab/Improv/Widening of KKH (Mansehra-Khunjerab Section), 212 Km	18,500.0						c	a	a	
RD-49	810	Faisalabad-Multan Motorway M-4	22,080.0						a	b	c	
RD-50	820	Periodic Overlay on M2 & Realignment of Sal Range	11,840.0						a	a	a	
RD-51	510	Khanewal-Leghanam-Uch Sharif-Mithankot-Rajanpur Motorway M-5	42,000.0						a	a	c	
RD-52	840	Karachi-Hyderabad Motorway M-9 (136km)	7,000.0						a	b	c	
RD-53	850	Peshawar Northern Bypass (26km)	3,078.1						a	a	c	
RD-54	860	Rawalpindi Bypass (28km) & Tarnol Interchange N-5	3,429.1						a	a	c	
RD-55	870	Lakpass Tunnel (N-25)	567.4						b	a	b	
RD-56	890	Sirahsira Flyover N-5	4,500.0						a	b	c	

APPENDIX Vehicle Operating Cost (VOC)

Vehicle Operating Cost at Average Speed by Vehicle Type

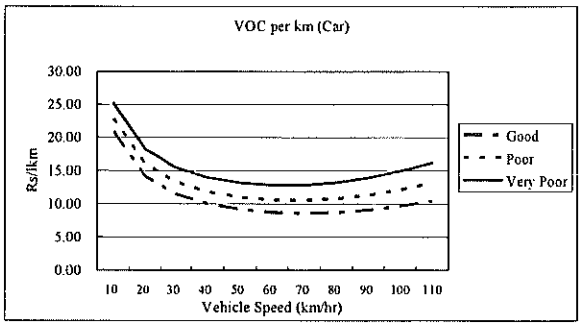
(November 2005) (Rs./km)

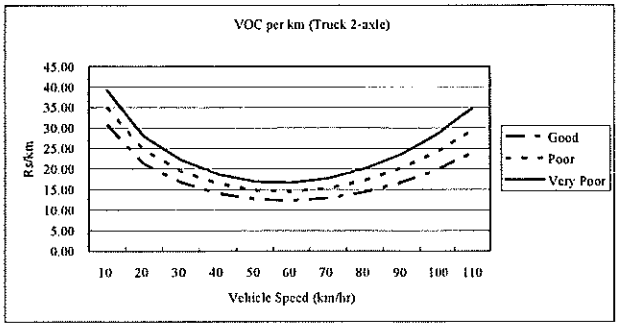
Vehicle Type	Average Speed Km / h	Financial Cost Road Condition (Roughness)					Economic Cost Road Condition (Roughness)				
		Very Good (r-2500)	Good (r-3000)	Fair (r-3500)	Poor (r-5000)	Very Poor (r-7000)	Very Good (r-2500)	Good (r-3000)	Fair (r-3500)	Poor (r-5000)	Very Poor (r-7000)
Motorcycle	40	2.07	2.08	2.09	2.34	2.61	1.45	1.46	1.47	1.65	1.84
Car	50	6.95	7.06	7.16	7.86	8.78	4.83	4.91	4.98	5.48	6.12
Wagon	45	12.46	12.96	13.48	15.41	18.47	9.24	9.59	9.96	11.41	13.58
Minibus	45	15.80	16.77	17.77	21.46	26.04	12.57	13.32	14.10	16.97	20.52
Bus	50	24.09	25.35	26.58	32.09	38.73	19.19	20.14	21.06	25.23	30.21
Truck (2-axle)	40	18.93	19.38	19.81	22.72	26.01	13.76	14.06	14.35	16.41	18.71
Truck (3-axle)	40	22.27	22.88	23.45	26.51	30.08	16.46	16.87	17.25	19.39	21.86
Truck (Trailer)	40	27.81	28.47	29.10	33.11	37.60	21.22	21.67	22.11	25.00	28.18

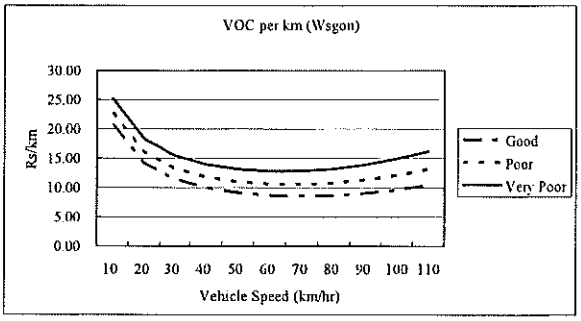
Source: Updated from NTRC data (2000)

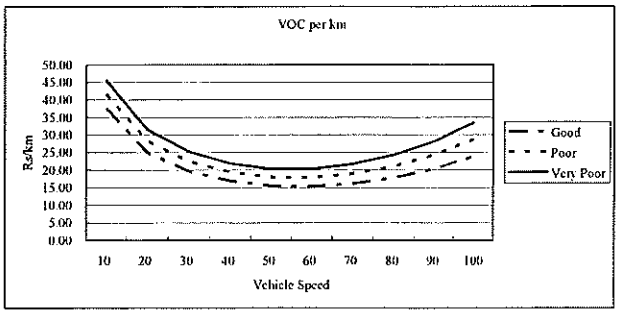
Vehicle Speed and Vehicle Operating Cost

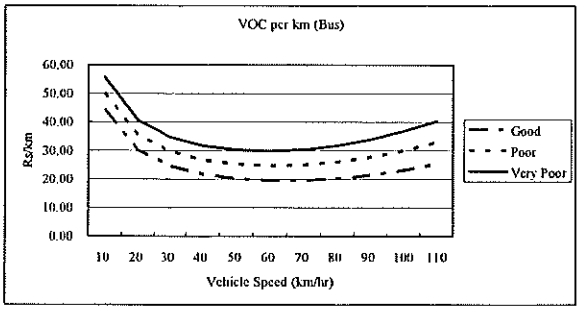
Economic Cost (November 2005)

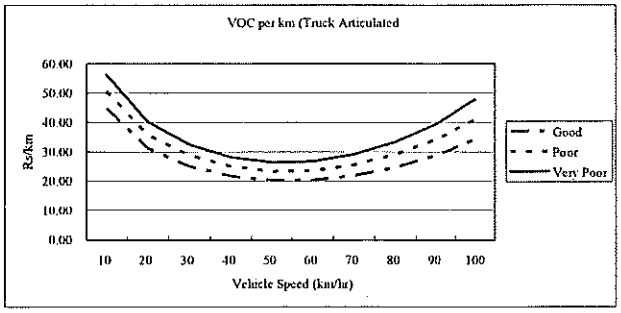












10. Restoration of Road and Bridges damaged by the Earthquake

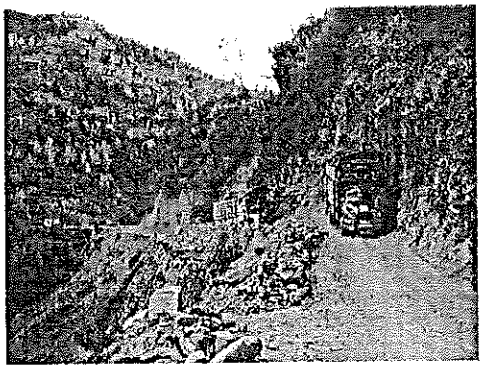
10.1 Road Damage in AJK

Summary of Road Damage in AJK

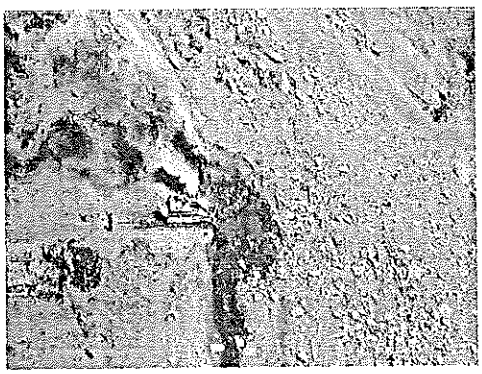
Agency			PWD		LGRD	Total
Type of Road		Major	High	Low	Low	
Muzaffarabad	Total Length (km)	156	748	323	978	2,205
	Damaged Length (km)	83	396	171	587	1.237
	Damage Cost (PRs Million)	668	2.522	282	956	4,630
Poonch	Total Length (km)	167	523	12	983	1,685
	Damaged Length (km)	65	204	5	393	667
	Damage Cost (PRs Million)	423	2.224	11	590	2,247
Bagh	Total Length (km)	154	446	16	799	1,415
	Damaged Length (km)	55	161	6	240	461
	Damage Cost (PRs Million)	638	1,172	23	479	2,312
Total	Total Length (km)	477	1,717	351	2,760	5,205
	Damaged Length (km)	203	761	182	1,220	2,366
	Damage Cost (PRs Million)	1,729	4,918	517	2,026	9,190

PWD: Public Works Department, LGRD: Local Government & Rural Development Department
Major: Main highways, High: Paved roads, Low: Earthen/shingled roads.

In the three affected districts of AJK, Muzaffarabad, Poonch and Bagh, it is estimated that about 2,366 km roads were damaged. Of this, 203 km are major roads, 761 km are other paved roads, and 182 km are unpaved roads for a total of 1,146 km represent 45% of the total PWD-managed roads. Among major roads, two primary arteries in AJK, the Neelem Valley Road and, to a lesser extent the Jehlum Valley Road were severely damaged. Another 1,220 km of local unpaved roads developed with community participation and managed by LGRD are damaged. This represents 44% of the total LRGD roads in the affected districts. The associated damage in AJK is estimated as Rs. 9,190 million.



Jhelum Valley Road



Neelum Valley Road at Kohori

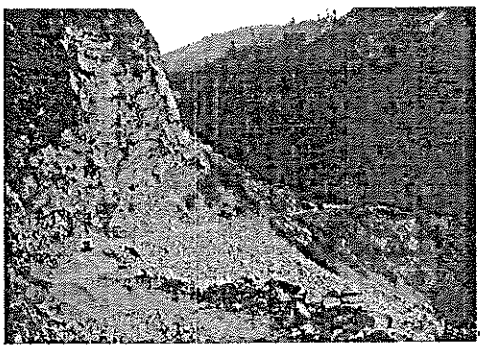
10.2 Road Damage in NWFP

Summary of Road Damage in NWFP

Agency		FHA		W&S/DC		MC		Total
		Provincial Highways	Secondary Highways	Access Roads		Urban Roads		
Type of Road		High	High	High	Low	High	Low	
Abbottbad	Total Length (km)	58	230	560	949	123	21	1,940
	Damaged Length (km)	5	29	255	0	15	3	306
	Damage Cost (PRs Million)	43	186	511	0	76	5	821
Battagram	Total Length (km)	103	108	88	54	0	0	354
	Damaged Length (km)	43	99	88	54	0	0	284
	Damage Cost (PRs Million)	366	645	260	68	0	0	1,338
Kohistan	Total Length (km)	27	127	161	317	0	0	632
	Damaged Length (km)	6	40	142	208	0	0	396
	Damage Cost (PRs Million)	51	261	419	260	0	0	991
Mansehra	Total Length (km)	253	347	333	2,229	29	21	3,212
	Damaged Length (km)	31	298	333	0	5	4	671
	Damage Cost (PRs Million)	264	1,943	638	0	27	8	2,878
Shangla	Total Length (km)	107	93	213	105	0	0	519
	Damaged Length (km)	44	58	198	105	0	0	405
	Damage Cost (PRs Million)	374	376	584	131	0	0	1,465
Total	Total Length (km)	549	905	1,356	3,549	152	42	6,658
	Damaged Length (km)	129	523	1,016	367	21	6	2,063
	Damage Cost (PRs Million)	1.097	3,411	2,412	459	103	13	7,494

FHA: Frontier Highway Authority, W&S: Works and Services Department, DC: District Council, MC: Municipal Committee.
High: Paved roads, Low: Earthen/shingled roads.

In NWFP, about 2,063 km roads were damaged representing 31% of the total road network n the five affected districts of Abbotabad, Battagram, Kohistan, Mansehra and Shangla. Of this, 652 km are provincial highways managed by FHA, 1,016 km are other paved provincial roads managed by the districts, 367 km are unpaved district roads, and 27 km urban roads managed by municipal agencies. Estimates of the associated damage in NWFP are to the tune of Rs. 7,494 million.



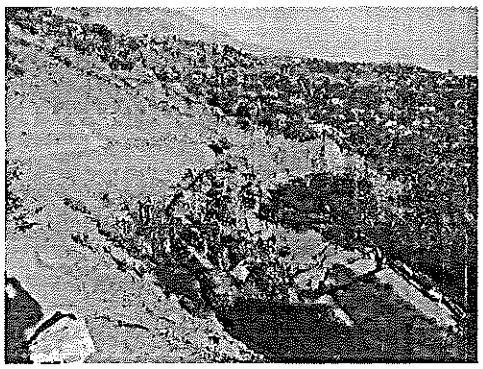
Large scale slope failure on provincial highway in NWFP, Shinkiarai - Nawaz Abad Road in Mansehra District

10.3 Damage to National Highways

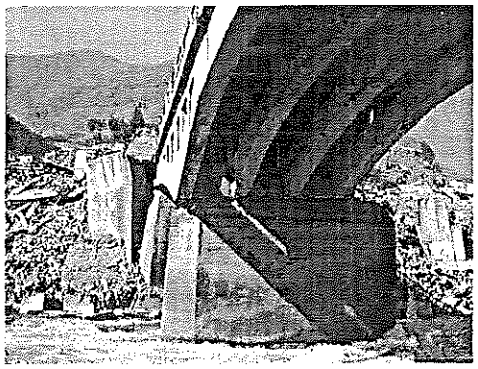
Summary of Damage to National Highways

	N35: Manselura - Pattan	N15: Mansehra - Naran	N75: Kohala - Muzaffarabad	Total
Total Length (km)	141	93	40	274
Damaged Length (km)	80	98	16	194
Damage Cost (PRs Million)	1,080	2.191	210	3,481

The three national highways, damaged by the earthquake include Mansehra – Pattan (N35), Mansehra – Naran (N15) and Kohala – Muzaffarabad (N75). The damaged length is about 194 km representing 72% of the total length. Estimates of associated damage to the national highways are Rs. 3,481.



N35: Collapsed roadway by landslide

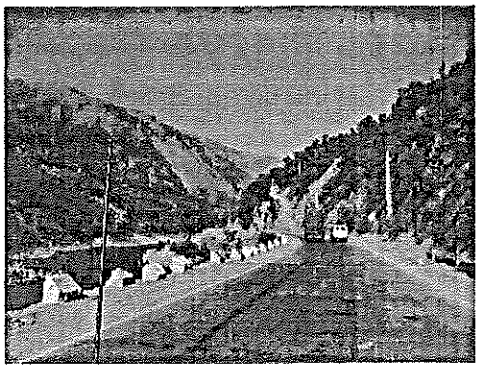


N15: The entire deck of the Balakot Bridge moved about 1 m downstream side.

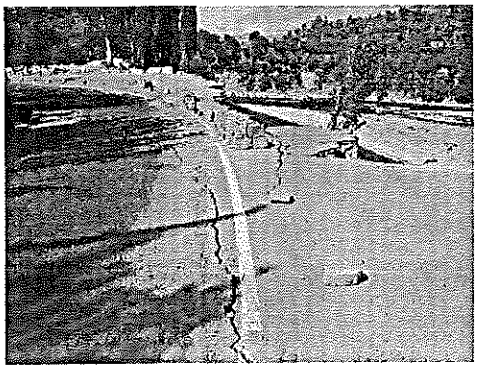
10.4 Damages on the Jhelum Valley Road

The Jhelum Valley Road is a 57 km long mountainous road running on the right bank of the Jhelum Valley River. The carriageway width is 5 m paved, with 1-1.5 m wide shoulders on both sides.

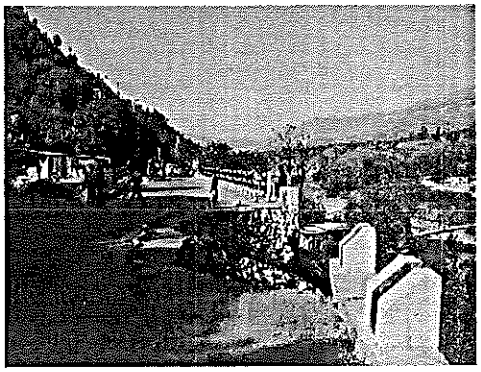
For nearly one-fourth of the entire length of the Jhelum Valley Road, the valley side shoulders or even carriageway fell down. There are sections where a large sliding surface was formed by the quake and road surface is depressed though it has not reached total failure. The hillside slopes collapsed and debris covers road surface in many sections.



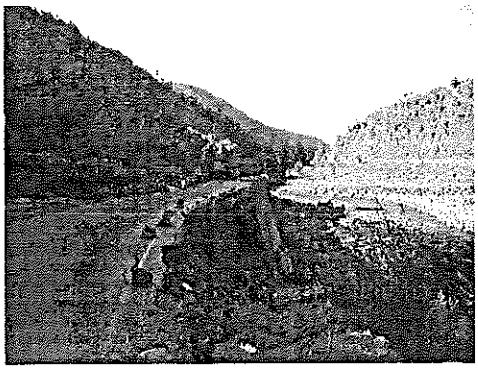
Standard section, 5 m carriageway and 1-1.5 m shoulders



Failure of one-lane width on valley side



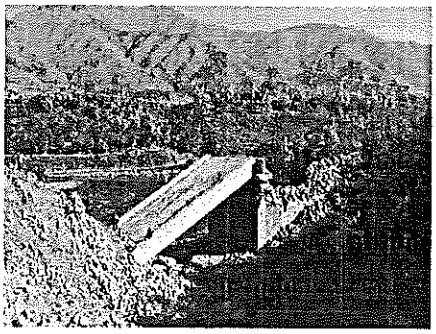
Damaged bridge approach



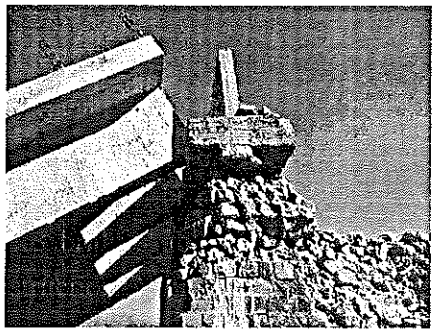
Collapsed stone masonry walls on valley side

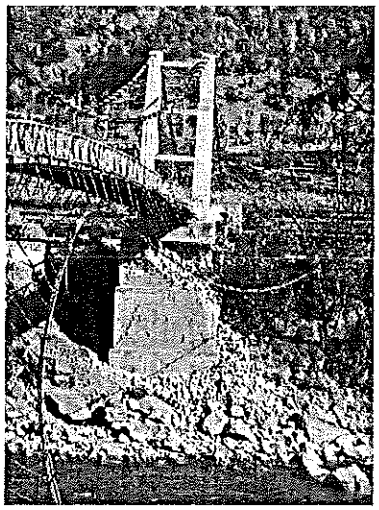
There exist 13 bridges on the main line of the Jhelum Valley Road, which cross over the rivers which flow into the Jhelum Valley. The bridge length is 10 m to 55 m. Long bridges are PC girder bridges (there are two 2-span bridges which uses PC girders for longer span and RC girders for shorter span), and short bridges are RC girder, RC slab and stone masonry arch bridges. Among 13 bridges, four bridges are seriously affected by the earthquake and require reconstruction or major rehabilitation. In addition, the Naily bridge, 40 m long PC girder (4 girders) located about 40 km from Muzaffarabad suffered damage. A half of superstructure moved by earthquake by 30 cm in lateral direction, and the unmoved one-lane width is utilized at present.

By the 10.8 earthquake, one suspension bridge fell down totally, one bridge is on the verge of falling-down, and decks of two bridges are twisted.



Collapsed stone masonry abutments of Subri Bridge, 6.6 km from Muzaffarabad

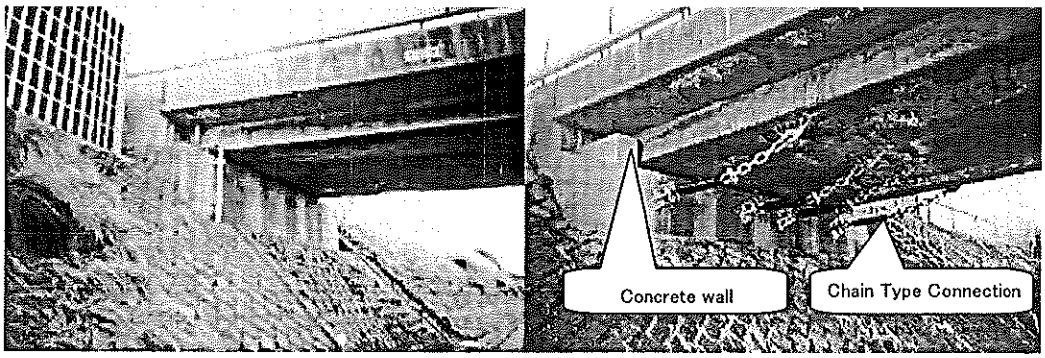




Suspension bridge over the Jhelum Valley, on the verge of falling down

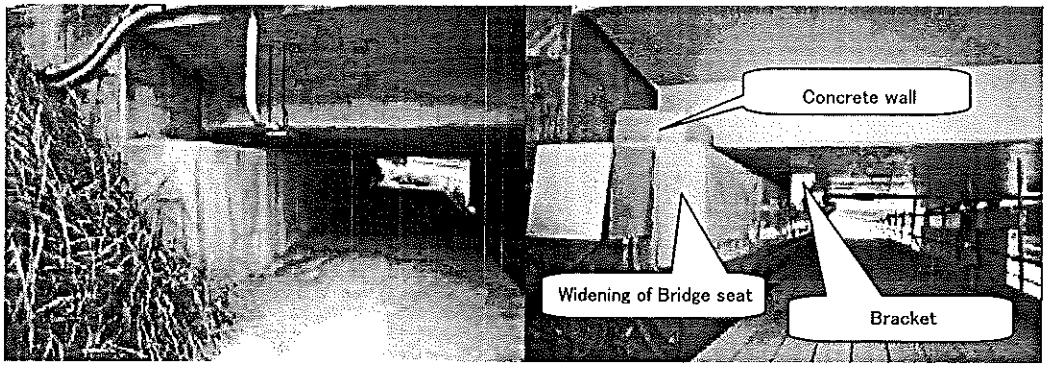
10.5 Examples of Measures for Bridge Falling Prevention in Japan

Chain type connection between substructure (abutment) and superstructure and provision of concrete walls on bridge seat

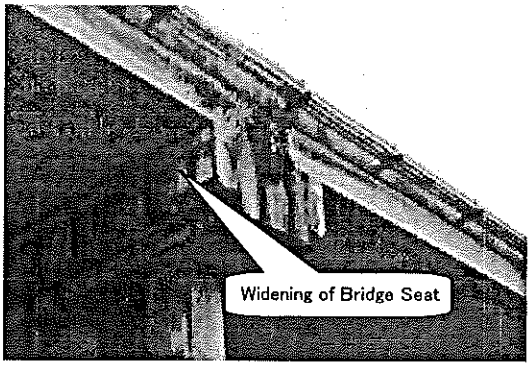


(Before) (After)

Provision of salience on under surface of substructure or bridge seat of superstructure.



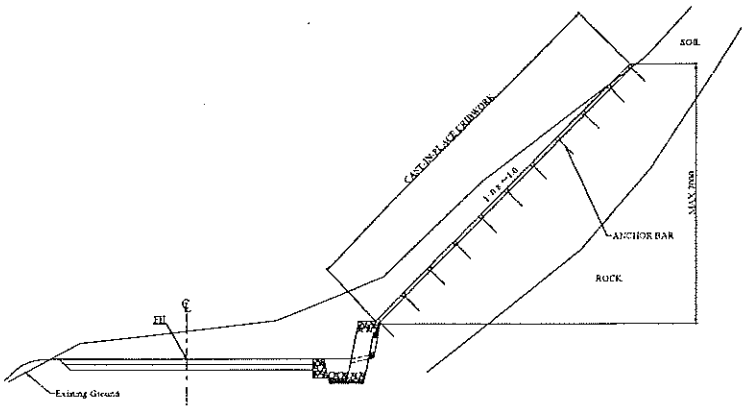
Widening of bridge seat (on pier) to prevent falling down of superstructure when unexpected large relative displacement occurs between superstructure and substructure.



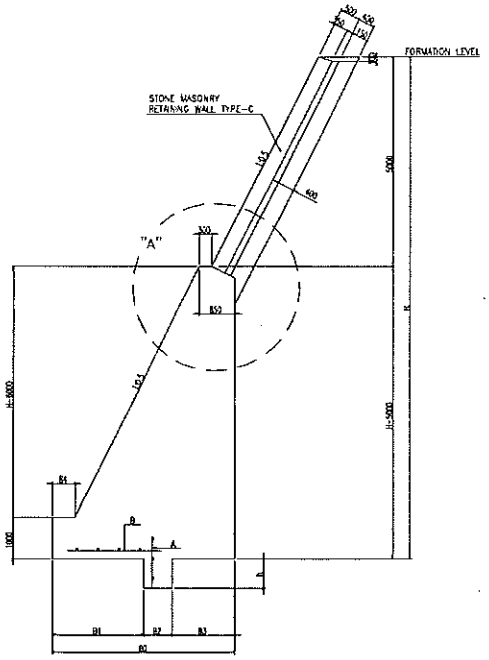
10.6 Slope Protection Works

For road construction in the mountainous regions, high cut or embankment is inevitable. Though slope protection works are not much introduced in Pakistan except for widely used stone masonry for river side walls, it is considered necessary to pay more attention to slope protection to increase stability against slope failure. Some of typical structures considered applicable to the conditions of the Jhelum Valley Road are illustrated below.

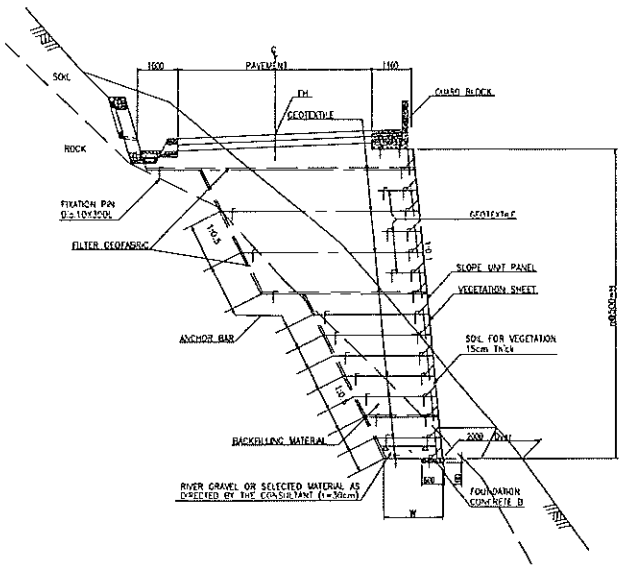
CAST-IN-PLACE CONCRETE CRIB



RETAINING AND BEAST WALLS



REINFORCED EARTH WALL



11 Toward Finalization of PTPS Master Plan

PTPS Master Plan will be finalized through the following process.

- The initial draft shall be checked in Japan by JICA with an assistance of the Advisory Committee by 25th of January, 2006.
- After revising the initial draft, if necessary, the draft final report shall be submitted to the Pakistan side at the beginning of February.
- On 15th of February (still tentative), the 4th Steering Committee Meeting will be held with two purposes: (1) presentation and discussion on the draft final report, (2) selection of two or three priority projects for the feasibility study.
- On 16th of February (still tentative), the first seminar will be held.
- Within one month after the 4th Steering Committee Meeting, the Pakistan side shall send the comments on the draft final report to the JICA Pakistan Office.
- After revising the draft final report, if necessary, the final report shall be submitted to the Pakistan side by the end of March.
- In April 2006, the Feasibility Study on the selected projects shall be commenced.

Table 11.1 Schedule for Finalization of Master Plan

Event	2006		
	Jan	Feb	Mar
Check by Japanese Advisory Committee	■ Modify		
DFR Submission to Pakistan Side		▲	
Seminar 1		▲	
4th Steering Committee		▲ Selection of FS Project	
Comment by Pakistan Side		■	■
DFR Submission to Pakistan Side			Modify ▲
Selection of F/S Project		■	